İSTANBUL TECHNICAL UNIVERSITY ★ INSTITUTE OF SCIENCE AND TECHNOLOGY

PROPOSAL OF AN ENVIRONMENTAL CODE OF PRACTICE AND ENVIRONMENTAL MANAGEMENT SYSTEM IMPLEMANTATION GUIDE FOR THE SHIPBUILDING AND SHIP REPAIR INDUSTRY

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FOREWORD

One of the mostly encountered systems in the 21st century becomes the Environmental Management which focuses basically on environmental protection and environmental impacts of organizations. For the shipbuilding industry, as being an international market, the importance of quality is beyond doubt. Quality concept has already proven its necessity in the market, but for the 21st century's multi-directional points of view, quality is not enough for a successful manufacturing organization. Consequently, the need for an Environmental Management System has arisen as a result of the decisive studies of environmentalist organizations, which leaded to toughened national and international legislation. This study, proposes an environmental management system implementation method for the shipbuilding and repair industry, giving the priority to legislation conformance without loosing competitiveness. Although ESPO (European Sea Ports Organization) has similar studies for the maritime area, as it only focuses on the environmental assessment of ports, this unique study will have the chance to be proposed to the relevant bodies of European Union, regarding shipbuilding and repair.

I would like to address my special thanks to my advisor, Assoc. Prof. İ. Deha Er for his contributions along my graduate study, both for directing my research parallel to my professional experience and also for providing me the best route possible on my interests. I am also grateful to the Board Members of İstanbul Shipyard both for their supports on my study and also for providing me the opportunity to experiment my findings on a field study.

May, 2006 H. Sena Nomak

CONTENTS

ABBREVIATIONS

CAR	: Corrective and preventive action request
CESA	: Community of European Shipyards' Association
CFT	: Cross Functional Team
DE	: IMO Sub-Committee of "Ship Design and Equipment"
EF	: Environmental Management System Form
EIA	: Environmental Impact Assessment
EMAS	: European Eco Management & Audit Scheme
EMR	: Environmental Management Representative
EMS	: Environmental management system
EP	: Environmental Management System Procedure
EPA	: Environmental Protection Agency
ESPO	: European Sea Ports Organization
EU	: European Union
HELCOM	: Helsinki Commission
HNS	: Hazardous and Noxious Substances
ICZM	: Integrated Coastal Zone Management
IMO	: International Maritime Organization
IMS	: Integrated Management System
IPPC	: Integrated Pollution Prevention and Control
ISO	: International Organization for Standardization
LCA	: Life Cycle Analysis
MARPOL	: International Convention for the Prevention of Pollution from Ships
MEPC	: Marine Environmental Protection Committee
NGO	: Non-governmental Organization
NASA	: U.S. National Aeronautics & Space Administration
OPRC	: International Convention on Oil Pollution Preparedness, Response and Cooperation
OSPAR	: Protection of the Marine Environment of the North-East Atlantic
QMS	: Quality Management System
SEA	: Strategic Environmental Assessment
SEAs	: Significant environmental aspects
SOLAS	: International Convention for the Safety of Life at Sea
TBT	: Tri-butyltin
TCA	: Total Cost Assessment
TQM	: Total Quality Management
VOC	: Volatile Organic Compound

LIST OF TABLES

LIST OF FIGURES

GEMİ İNŞA VE TAMİR SANAYİSİNE YÖNELİK ÇEVRESEL UYGULAMA KURALLARI ÖNERİSİ VE ÇEVRE YÖNETİM SİSTEMİ GERÇEKLEŞTİRME REHBERİ

ÖZET

21. yüzyılın en çok karşılaşılan sistemlerinden biri, temelde kurumların çevresel koruma ve çevresel etkilerine odaklanan çevre yönetimidir. Çevre konulu standartlar, etkin bir çevre yönetim sistemi operasyonu için gerekli olan kurumun çevresi ile genel süreç, ürün ve hizmetlerinin etkileri gibi ana elemanları içermektedir.

Uluslar arası bir pazar olan gemi inşa sanayisi için kalitenin önemi tartışılmazdır. Kalite kavramı piyasalarda önemini çoktan ispat etmiştir ancak 21. yüzyılın çok yönlü bakış açısı ile başarılı bir üretim kurumu için yeterli değildir. Bu sebeplerle ve çevreci kuruluşların kararlı çalışmaları ile ağırlaşan ulusal ve uluslar arası yasal düzenlemelerin sonucunda bir Çevre Yönetim Sistemi gereği doğmuştur.

Bu çalışma, gemi inşa sanayisi için çevresel konularla ilgili bir çevresel uygulama kuralları önerisi ile başlamaktadır. Bu çerçevede hem Avrupa hem de Dünya piyasaları ile ilgili olarak genel bir gözden geçirme yapılmış, çevresel konular ile ilgili girişimler özetlenmiştir.

Uygulama bölümünde, gemi inşa ve onarım işleri ile ilgili çevresel değerlendirmeler tartışılmış ve bir Çevre Yönetim Sistemi uygulamasının detayları önerilmiştir. Gemi inşa ve onarım sanayisinin temel süreçleri çevresel risk analizi ile detaylı olarak değerlendirilmiştir.

Son bölümde, kalite ve çevre konularını birleştiren bir entegre yönetim sistemi uygulama fikri teklif edilmiş, entegrasyonun kolaylıkları ve faydaları verilmiştir.

Tüm çalışma boyunca, çevresel yönetim omurgasının başarılı uygulama yöntemleri, sürekli iyileştirme anlayışı çerçevesinde tartışılmıştır. İzlenen tüm uygulama adımlarında uluslar arası yasal düzenlemelere uygunluk göz önünde tutulmuştur. Bu uygulamanın başarılı bir şekilde hayata geçirilmesi bir tersanenin piyasalardaki rekabetçi gücünü kaybetmeden, hem çevresel, hem de idari sorumluluklarını yerine getirmesini sağlayacaktır. Denizcilik alanında benzer çalışmalar ESPO (European Sea Ports Organization) tarafından gerçekleştirilmiş, ancak bunlar sadece limanların çevresel değerlendirmelerine odaklandığı için bu orijinal tez, Avrupa Birliği'nin ilgili organlarına gemi inşa ve onarım konuları ile ilgili olarak sunulabilme şansını ortaya çıkarmıştır.

Anahtar Kelimeler: Gemi İnşa, Tersane, Çevresel Yönetim Sistemi, Çevresel Etki

PROPOSAL OF AN ENVIRONMENTAL CODE OF PRACTICE AND ENVIRONMENTAL MANAGEMENT SYSTEM IMPLEMANTATION GUIDE FOR THE SHIPBUILDING AND SHIP REPAIR INDUSTRY

SUMMARY

One of the mostly encountered systems in the 21st century, becomes the Environmental Management which focuses basically on environmental protection and environmental impacts of organizations. Environmental standardization contains the major elements for the operation of effective environment management system, which includes environment side, affection for the general process and product and services those are performed in the organization.

For the shipbuilding industry, as being an international market, the importance of quality is beyond doubt. Quality concept has already proven its importance in the market, but for the 21st century's multi-directional points of view, quality is not enough for a successful manufacturing organization. Consequently, the need for an Environmental Management System has arisen as a result of the decisive studies of environmentalist organizations, which leaded to toughened national and international legislations.

This study starts with a policy proposal for the shipbuilding industry regarding environmental facts. Overview of the industry for both the European and the World markets are given in this concept and the initiatives undertaken are summarized. On the practice part, environmental assessment of the shipbuilding and repair business has been discussed and details of an Environmental Management System implementation has been proposed. Major processes of shipbuilding and repair industry are assessed in details, with the environmental view of risk analysis.

At the final part, idea of implementing an integrated management system of quality and environment is offered. Eases and benefits of the integration are given.

Along the study, methods of successful implementation of an environmental management backbone, with the concept of continual improvement are discussed. In all implementation steps guided, priority to the conformance of international legislation is assigned. Successful development of this implementation will result a shipyard to meet both environmental and administrative liabilities, while not loosing competitiveness in the market. Although ESPO (European Sea Ports Organization) has similar studies for the maritime area, as it only focuses on the environmental assessment of ports, this unique study will have the chance to be proposed to the relevant bodies of European Union, regarding shipbuilding and repair.

Keywords: Shipbuilding, Shipyard, Environmental Management System, Environmental Aspect

1. INTRODUCTION

Management is the broad based term for regulating the activities through set codes or systems to obtain the best results in terms of economy, time and human resources deployment; and a management system is the way to control the activities of a union by means of a formerly set structure.

One of the mostly encountered management systems in the 21st century, becomes the Environmental Management which focuses basically on environmental protection and environmental impacts of organizations. For the shipbuilding industry, as being an international market, competitiveness has great significance. Once quality concept has already proven its importance in the market, for the 21st century's multi-directional points of view, the need for an Environmental Management System has arisen.

Most important reasons for this development are the decisive studies of environmentalist organizations, which leaded to toughened national and international legislations.

Following a policy proposal for the shipbuilding industry regarding environmental facts, overview of the industry for both the European and the World market are given. The initiatives undertaken are summarized and on the practice part, environmental assessment of the shipbuilding and repair business has been discussed and details of an Environmental Management System implementation has been given. Also an idea of implementing an integrated management system of quality and environment is offered.

Along the study, methods of successful implementation of an environmental management backbone, with the concept of continual improvement are discussed. In all implementation steps guided, priority to the conformance of international legislation is assigned.

2. ENVIRONMENTAL POLICY CODE

The main environmental objectives which the shipbuilding sector should aim to achieve are:

1. To develop a sustainable shipbuilding infrastructure, for both new building and repair segments with the idea of continual improvement by generating new knowledge and technology and developing sustainable techniques which combine environmental effectiveness and cost efficiency. The aim is to achieve self-regulation and develop a bottom-up approach. Even if the governments decide to issue environmental regulations, the existing self-regulatory instruments, developed by the shipyards themselves and which address day-to-day practice, will provide a background to be used as a basis for governmental environmental policy. This will enable legislation to be more easily supported and implemented.

2. To encourage cooperation between shipyard managements and the relevant stakeholders (ship owners, shipyard workers, public, NGOs) to facilitate the reconciliation, at an early stage, of differing interests and the acceptance of shipyard projects by the local community.

3. To enhance cooperation between shipyard managements in the field of environment and facilitate the exchange of experiences and implementation of best practices on environmental issues to avoid unnecessary duplication and enable shipyard managements to share the costs of environmental solutions. This can be notably achieved through the participation of shipyards in a network. The aim is to create a level playing field by limiting poor environmental practice as a competitive factor between shipyard managements.

4. To encourage shipyard managements to conduct appropriate environmental impact assessments for shipyard projects and appropriate strategic environmental impact assessments for shipyard development plans to assess, at an early stage, how their effects on the environment can be minimized.

3. ENVIRONMENTAL SHIPYARD POLICY BACKGROUND

3.1 Overview of the shipyard industry

Shipbuilding industry has strategic importance in many respects. It develops advanced technologies that offer considerable spin-offs to other sectors; it provides essential means of transport for international trade; and it supplies modern navies with advanced vessels.

In high-tech industry sectors such as shipbuilding, success is first of all based on knowledge. Only in Europe exists such a dense network of shipyards, equipment suppliers, research centers and other providers of advanced technologies and engineering services.

3.1.1 European Industry

European Shipbuilding is a strong and dynamic industry. As a result of an impressive streamlining, coupled with pro-active outsourcing strategies and continuous innovation in production methods, a network of highly specialized companies has developed to become one of the competitive advantages of the European shipbuilding industry. Typically 60 to 75% of the values of a new ship are goods and services provided by marine equipment and service industries.

Shipbuilding is an important and strategic industry in a number of EU Member States. Shipyards often play a significant role for the regional industrial infrastructure and with regard to military shipbuilding, for national security interests.

There are more than 150 shipyards in the EU, with about 40 of them active in the global market for large sea-going commercial vessels; 350.000 people are directly employed by yards and the marine equipment industry (which has around 9.000 companies). More than half of the industry's turnover of about 34 billion Euro is achieved through exports.

The European shipbuilding industry is the global leader in the construction of complex vessels such as cruise ships, ferries, mega-yachts and dredgers. It also has a

strong position in the building of submarines and other naval vessels. Equally, the European marine equipment industry is world leader for a wide range of products, from large diesel engines to electronics.

3.1.2 Key Data

- The European shipbuilding industry holds approximately 20% of the world shipbuilding capacity.
- Member Shipyards provide more than 100,000 high qualification jobs through direct employment and generate at least three times as many in the marine equipment and service industries in Europe.
- The annual turnover of shipyards represented by CESA in 2003 was 14.4 billion Euro in merchant shipbuilding and 2.1 billion Euro in ship repairing. Exports accounts for roughly 70% of the total turnover.
- As key drivers of maritime excellence, European shipyards invest on average approximately 10% of their turnover on research, development and innovation **[1]**.

3.1.3 World Market

Commercial shipbuilding and ship repair have always operated in a truly global market, with yards competing for contracts within and outside their own countries. This early and comprehensive exposure to the forces of globalization makes shipbuilding substantially different from most other manufacturing industries. However, market mechanisms are not allowed to function properly due to government interventions in several countries. While a strong state aid discipline exists in the EU, no specific discipline applies at international level.

While most industries are effectively covered by existing multilateral trade rules, shipbuilding, due to its own characteristics, is not easily amenable to the application of those rules. Today, shipbuilding is not subject to an anti-dumping discipline or to custom duties. In conclusion, the shipbuilding sector is practically the only industry without effective protection against unfair trading practices.

3.2 Initiatives undertaken about the Shipbuilding Sector in the field of environment

3.2.1 Protection of fuel tanks

In 2004, the IMO Sub-Committee "Ship Design and Equipment (DE)" addressed the risk associated with the carriage of large amounts of unprotected fuel oil in all ship types, which in case of container vessels have bunker capacities in excess of the cargo tank volumes of small tankers requiring double-hull protection **[2]**.

In order to prevent or reduce spillage of oil carried as fuel in case of collision or stranding, DE 48 developed a new draft MARPOL Annex 1 regulation Oil Fuel Tank Protection that is intended to apply to all new ships (and major conversions) with an aggregate oil fuel capacity of 600 m^3 and above.

The draft regulation gives requirements for the protective location of the fuel tanks (double-hull requirements based on aggregate fuel tank capacity) and includes a maximum capacity limitation of 2 500 m^3 per oil fuel tank. Based on a CESA submission, the Sub-Committee decided on the use of the probabilistic approach (simplified oil outflow analysis) as an alternative method to prescriptive double-hull requirements.

3.2.2 Ballast water management

According to the International Convention for the Control and Management of Ships' Ballast Water and Sediments, all ships will have to implement a Ballast Water and Sediments Management Plan, to carry a Ballast Water Record Book and they will be required to carry out ballast water management procedures to a given standard. Existing ships will be required to do the same, but after a phase-in period **[3]**.

3.2.3 Recycling of ships

In December 2003, the "Guidelines on Ship Recycling" had been adopted by the IMO General Assembly **[4]**. The guidelines give advice to all stakeholders involved in the life cycle of a ship, i.e. administrations, flag, port and recycling states, as well as shipbuilders, repairers and recycling yards. Amongst others, they introduce a "Green Passport" to accompany the ship through its lifetime and an inventory of

potentially hazardous materials. The guidelines also address a number of issues with direct relevance for shipbuilders and repairers:

- Ship designers and shipbuilders are encouraged to use preferably materials which can be safely recycled and to minimize the use of materials known to be potentially hazardous to health and the environment;

- If possible, ship/equipment designers are encouraged to recommend designs to ship operators that minimize/prevent waste at the source/end of the operating life of the ship; Substances prohibited or restricted by International Conventions should not be used in the construction, refit and repair of ships;

- Ship designers and shipbuilders, without compromising safety or operational efficiency, are encouraged to facilitate recycling and removal of hazardous materials.

3.2.4 Air pollution from ships

MARPOL Annex VI on Air Pollution from Ships has entered into force on 19 May 2005 after the ratification thresholds for entry into force have been met **[5]**.

They relate to the designation of the North Sea area as a "SO_x Emission Control Area". Also, progress was made on the draft Guidelines on the CO_2 Indexing Scheme. IMO Member States were urged to carry out trials using the scheme and to report to the next MEPC. MEPC agreed that a CO_2 indexing scheme should be simple and easy to apply and take into consideration matters related to construction and operation of the ship, and market based incentives.

Regarding the air pollution from ships in ports, further studies are done about precautionary approaches to port related air pollution to encourage local production of goods in order to reduce marine traffic, greener design for new terminals, and state-of-the art approaches to emissions control that have been successfully demonstrated at ports throughout the world **[6]**.

3.2.5 MARPOL Annex I and Annex II revision

The revised MARPOL Annex I Regulations for the Prevention of Pollution by Oil was adopted by MEPC 52 and is expected to enter into force on 1 January 2007. It incorporates the various amendments adopted since MARPOL entered into force in 1983, including the amended regulation on the phasing-in of double hull

requirements for oil tankers. It also separates, in different chapters, the construction and equipment provisions from the operational requirements and makes clear the distinctions between the requirements for new ships and those for existing ships. The revision intends to provide a more user-friendly, simplified in Annex I **[7]**.

New requirements in the revised Annex I include new regulation regarding Pump-Room Bottom Protection: on oil tankers of 5 000 tones deadweight and above constructed on or after 1 January 2007, the pump-room shall be provided with a double bottom; regulation on Accidental Oil Outflow Performance - applicable to oil tankers delivered on or after 1 January 2010; construction requirements to provide adequate protection against oil pollution in the event of stranding or collision.

4. HANDBOOK OF RECOMMENDED ENVIRONMENTAL PRACTICES AND IMPLEMENTATION GUIDE

In section 4.1, an overview of environmental legislations as well as their effects on shipyards are presented.

This section also makes a number of important recommendations to shipyard managements to manage the implementation of EU legislation in accordance with the principles highlighted in the "Environmental Policy Code" in section 2.1. It does not include mandatory requirements. EU legislation is implemented in different ways at the national and local levels; responsibility for the implementation of environmental legislation and policy varies from shipyard to shipyard and from member state to member state. Practical guidelines to shipyard managements are provided for shipyards when developing their environmental policies. Section 4.2 presents shipyard environmental management tools, which can be used to deal with the issues developed in section 4.1.

4.1 Environmental Framework for Shipyard Managements

The role of shipyard managements in coping with the environmental issues can be analyzed in 2 different perspectives:

- Shipyard area (land and sea)

- Ship / Shipyard interface

The following sections will demonstrate that the shipbuilding and repair industry is committed to developing voluntary schemes in order to move towards self-regulation.

4.1.1 Shipyard Area – Development and Environmental Aspects

The activities of industries located in the shipyard area affect the shipyard area as a whole. As a result, the interests of the shipyard management are also related to the environmental effects of the actions undertaken by industries in the shipyard.

Development: Global competition puts pressure on European shipyard managements to offer quality and economy which accommodate the wishes of their customers. On the other hand, shipyard development in Europe is more and more constrained by scarcity of land, urban development and ecological considerations. Shipyard development can be affected by the requirements of a series of Directives: Environmental Impact Assessment (EIA), Strategic Environmental Assessment (SEA), Conservation of Wild Birds and Conservation of Natural Habitats and of Wild Flora and Fauna. Moreover, shipyard development should be seen in the context of Integrated Coastal Zone Management (ICZM). This approach requires a comprehensive assessment, setting of objectives and planning of coastal systems and resources **[8]**.

The environmental principles set in the above-mentioned Directives can conflict with the interests of shipyards, as the fulfillment of these requirements may hamper the development of shipyard projects, therefore lead to great delays in their completion and increase costs. The implications are heavily influenced by the way legislation is transposed into national legislation, as well as by the national and regional-specific rules.

Recommended guidelines: Bearing in mind the legal framework and the system of planning consents as operated in each member state, it is recommended that:

- Shipyard managements conduct appropriate environmental impact studies where possible, even if not strictly required under the terms of the Environmental Impact Assessment Directive;

- All shipyard management's plans make sure they collect the public and stakeholders' opinion in the planning period, according to the Strategic Environmental Assessment Directive; a carefully designed public outreach program can ensure the involvement of all stakeholders;

- Shipyard managements get involved in the early processes of designation of protected areas.

Environmental Aspects of Shipyard Phenomena and Shipbuilding Industry:

Definitions and Relationships: An environmental aspect is defined as an element of a facility's activities, products, or services that can or does interact with the environment. These interactions and their effects may be continuous in nature,

periodic, or associated only with events, such as emergencies. Traditional environmental impacts related to building processes are considered to be emissions of noise and dust during sandblasting and painting. In addition, the efficiency of the usage of steel plates has been of some concern. Important processes are cutting, forming, joining, grinding, sandblasting, painting and outfitting. The most important environmental aspects concerning those processes are mainly local aspects with relation to air and water **[9]**.

An environmental impact is defined as any change to the environment, whether adverse or beneficial, resulting from a facility's activities, products, or services.

A significant environmental aspect is one that may produce a significant environmental impact **[10]**.

In short, the aspect is the cause and the impact is the effect.

Environmental Aspects and Environmental Impacts:

Environmental Aspect	→	Environmental Impact(s)
Emissions of volatile organic Compounds (VOC's)	→	Air pollution, smog
Discharges to stream	→	Degradation of aquatic habitat and drinking water supply
Spills and leaks	→	Soil and groundwater contamination
Electricity use	→	Air pollution, global warming
Use of recycled paper	→	Conservation of natural resources

Selected Techniques and Data Sources for Identifying and Evaluating Environmental Aspects and Impacts: There are numerous techniques and data sources to assist in identifying and evaluating environmental aspects and impacts at the facility. Note that much of the data collected to date will be useful as environmental aspects are identified and their significances are determined.

In determining environmental aspects, considerable consensus building and professional judgments are required to develop conclusions about risk. This is because how to evaluate all the factors that determine ecological risk is not well defined and is subject to interpretation. Individual measures must weighted by the quality and reliability of their data and risk must be estimated from the preponderance, magnitude, extent, and strength of causal relationships between the data on exposure and effects. Systematically weighing the evidence of risk rendered

conclusions about risk in a manner that was clearly defined, objective, consistent, and did not rely solely on professional judgment **[11]**. In table 4.1, list of techniques and data sources for determining environmental aspects are given with the correct situations to be used.

Table 4.1: List of techniques and data sources for determining environmental aspects.

Techniques and Data Sources	When Best Used
Emission Inventories	Used to quantify emissions of pollutants to the air. Some data on emissions or chemicals of concern may already be available.
Environmental Compliance Audits	Used to assess compliance with federal, state, and local environmental regulations. These methodologies are in common use. Their scope and level of detail vary.
Environmental Cost Accounting	Used to assess the full environmental costs associated with activities, products, or services.
Environmental Impact Assessments	Used to satisfy requirements regarding the evaluation of environmental impacts associated with proposed projects.
Environmental Property Assessments	Used to assess potential environmental liabilities associated with facility or business acquisitions or divestitures.
Failure Mode and Effects Analyses	Commonly used in the quality field to identify and prioritize potential equipment and process failures as well as to identify potential corrective actions.
Life Cycle Assessments	Used to assess the cradle-to-grave impacts of products or processes, from raw material procurement through disposal.
Pollution Prevention or Waste Minimization Audits	Used to identify opportunities to reduce or eliminate pollution at the source and to identify recycling options.
Process Flow Diagrams	Used to allow an organization to visualize and understand how work gets accomplished and how its work processes can be improved.
Process Hazard Analyses	Used to identify and assess potential impacts associated with unplanned releases of hazardous materials.
Project Safety/Hazard Reviews	Used to assess and mitigate potential safety hazards associated with new or modified projects.
Risk Assessments	Used to assess potential health and/or environment risks typically associated with chemical exposure.

A recommended approach, which is described in detail below, is based on creating

process decision-making flow diagrams. This approach is recommended because it will give a thorough understanding of all of the facility's processes. Each process is observed one by one in details, then the groups of processes taking place in the same functional area are assessed with their common impacts. Below, is given the common activities and processes with their functional areas at shipbuilding and ship repair facilities.

Table 4.2: List of Common Activities and Processes with Functional Areas at Shipbuilding and Ship Repair Facilities:

Activity and Process	**Functional Area**
Drydock Painting	Construction and Repair
Small Parts Coating, Outdoor	
Gas Metal Arc Welding	
Dry Abrasive Blasting	
Burning and Cutting	
High Pressure Water Jetting	
Metal Grinding	
Material Transport, Crane	
Metal Working	
Bilge Cleaning	
Fiberglass Reinforced Construction	
Other Painting, Coating, and Plating	
Pipe Fabrication, Aluminum Fabrication, Steel Fabrication	
Metal Plating and Surface Finishing	
Other Machining and Metal Working	
General Repairs	Maintenance
Storage of Materials and Waste: paint and solvents, metals, hydraulic fluids, lube oils, paint waste, blasting media, welding gases, universal waste, diesel, fuel, gasoline	Raw Materials Management and Waste Accumulation
Hazardous Waste Disposal	Waste Disposal and Treatment
Universal Waste Disposal	
Wastewater Disposal	
Wastewater Treatment	
Fuel Storage and Transfer	Maintenance and Operation
Electrical Generation	
Compressed Air Generation	
Steam Generation	
Administration	General Support

In Appendix-B, main processes of shipbuilding and ship repair are observed in details. After each process given, aspect identifications and significance determinations are done **[12]**.

4.1.1.1 Dredging and Disposal of dredged material

Dredging is an essential activity for maintaining accessibility to shipyards and has come under pressure because of environmental considerations. The designation of protected areas under the Habitats Directive poses limitations on both dredging and disposal of dredged material **[13]**.

Furthermore, in some shipyards, dredged material may be contaminated to an extent that environmental requirements need to be fulfilled before its disposal. The disposal of dredged material is closely controlled through permits provided by national legislation which originates, in the North-East Atlantic, from the OSPAR Convention **[14]**, in the Baltic Sea Area from the Helsinki Convention **[15]**, in the Mediterranean Sea Area from the Barcelona Convention and in the Black Sea Area from the Bucharest Convention. The OSPAR Commission and the Helsinki Commission (HELCOM) have adopted similar guidelines addressing specifically the disposal of dredged material in the maritime area. Both guidelines put a big burden in terms of information requirements and related costs **[16]**.

Also recent studies for the beneficial use of dredged material are developed, whose primary objective is to identify cost effective and environmentally acceptable alternatives for the placement of dredged materials **[17]**.

Recommended guidelines: Where shipyards are involved in dredging activities, it is recommended to:

- get involved in consultations with the competent authorities on the impact of legislation on their dredging activities;

- minimize the effects on the environment of dredging operations as far as practicable and according to the Technical Annex included in both the OSPAR and HELCOM guidelines;

- depending on their geographical position, adopt the guidelines of the OSPAR Commission or the recommendations of the Helsinki Commission for the disposal of dredged material by dumping in the maritime area; and

- exchange information and best practice experience on a voluntary basis.

4.1.1.2 Soil Contamination

The shipyard area historically accommodates a great range of activities, which are, or have been, the source of soil contamination. From the point of view of a shipyard management, soil contamination means damage to the sites that it rents, and consequently a reduction in value of its assets. This can lead to complex and time-consuming juridical processes aiming at the restoration of the site, puts pressure on attractiveness for new investors, and delays potential income from rent and spin-off activities because the site cannot be used. In several shipyards, land lease contracts therefore contain environmental paragraphs. A certain financial risk for the shipyard management remains, especially if the tenant is insolvent or cannot be traced after the end of their contract.

For a better protection of the interests, shipyard managements are recommended to:

- create a clear and consistent soil policy aiming at preventing financial and environmental risks;

- incorporate soil management aspects into contracts with their tenants;

- nominate representatives for communication with and control of their tenants;

- create facilities to inform and stimulate the tenants about their responsibilities; and

- monitor the shipyard area for early identification of soil contamination sources.

4.1.1.3 Noise management

Determining “noise capacity” consists of setting the limits for permissible noise levels for individual companies as well as for the shipyard area as a whole. A good functioning noise management system will have the character of a social, environmental as well as commercial instrument. Shipyard managements have already been trying to find a balance between facilitating the needs of their tenants and making the most efficient use of the shipyard area within the existing noise limits.

Shipyard managements are recommended to:

- get involved in early consultations with the competent authorities responsible for making the noise maps and action plans;

- develop instruments/tools to enhance the efficient use of the available noise capacity; and

- take initiatives to voluntary exchange best practice experience in shipyard area noise management.

4.1.1.4 Shipyard Waste Management

Shipyard activities produce waste that has to be removed following certain rules. Important variations can be observed in the national legislation of member states regarding the responsibility for waste management.

Waste does not only involve costs, it also entails a commercial possibility as waste can mean money if it is reused, recycled or burned for energy recovery. Waste management should involve the channeling of waste using systems which are technically proven, commercially viable and which comply with national and EU public health and environmental safeguards.

Some of the most important hazardous wastes of the shipyard environment are the antifouling wastes, sandblast waste and ship hull washing wastewater **[18]**. These can be detoxified by processes of heat treatment and solvent extraction **[19]**.

Shipyard managements are recommended to put into practice an action program for:

- waste prevention;

- waste recovery; and

- waste disposal.

4.1.1.5 Water Quality and Management

The Water Framework Directive is set as the basis of the water strategy of the European Union. The Directive introduces a system of water management by river basin - the natural, geographical and hydrological unit - instead of according to administrative or political boundaries. It covers all types and uses of water, including surface water, groundwater, transitional and coastal waters.

Also, the stormwater management is a very useful tool for the handling of polluted water **[20,21]**. Several projects with different methodologies of collection and filtration has been implemented, such as passive treatment systems with filtering media **[22]**, or sorbent material **[23]**.

Shipyard managements are recommended to:

- get involved in the early processes of defining boundaries of water bodies and defining the water bodies themselves;

- get involved in the consultation process with the competent national authorities and ensure that they inform these authorities of their interests;

- participate fully in the preparation and delivery of the appropriate river basin management plans;

- prepare plans to ensure efficient use of water.

4.1.1.6 Air Quality and Management

Air quality in the shipyard area is mainly affected by emissions from the shipyard-based industrial activity. Shipyard managements are often the receivers of air-related complaints (e.g. dust, odors) from the local community. The public perception about the responsibility of the shipyard managements can cause increased public pressure on shipyard-related projects, accompanied by delays and increased expenditures for the shipyard managements.

The Directive on the Ambient Air Quality Assessment and Management sets the basic principles of the EU air quality strategy **[24]**. Targeting the sources of air pollutants, VOC emissions directive controls the Volatile Organic Compound (VOC) emissions resulting from the storage of oils, painting and coating operations **[25]**, the Integrated Pollution Prevention and Control (IPPC) Directive controls the emissions from a wide range of industrial installations **[26]**. The directive on the incineration of waste sets operational conditions and technical requirements for Waste Incineration Plants **[27]** and the directive sets the limitation of emissions of certain pollutants into the air from large combustion plants **[28]**.

Shipyard managements are recommended to:

- take the appropriate measures in order to comply with the emission limit values that apply for any installations that they own and operate;

- nominate representatives for communication with and control of their tenants;

- engage in dialogue with the local community in order to facilitate better understanding of the role of shipyard managements;

- inform themselves on how companies in the shipyard area apply the provisions of the Directive on the Control of Volatile Organic Compounds from the storage of oil, painting and coating operations; and

- monitor the shipyard area for early identification of air quality problems.

4.1.1.7 Monitoring the Shipyard Environment and Reporting

Whilst recognizing that specific responsibility for monitoring within a shipyard area will vary from shipyard to shipyard and from member state to member state, monitoring can be of particular importance to help shipyard managements to foresee, anticipate and avoid environmental damage liabilities under the forthcoming Environmental Liability Directive as well as damage to their sites from the activities of their tenants. In this context, it would be useful for shipyard managements to make an assessment of the environmental risks in the shipyard area.

Shipyard managements are recommended to:

- Identify environmental performance indicators relevant to their major environmental issues in order to facilitate monitoring of their environmental performance;

- Establish monitoring which is geared towards obtaining information relevant to the chosen environmental performance indicators; and

- Produce a publicly available annual environmental report.

4.1.1.8 Shipyard Preparedness and Contingency Plans

Although monitoring establishes a 'proactive' approach, as it helps shipyard managements identify problems at an early stage, the 'reactive' approach is also very important to assist shipyard managements in minimizing the financial and environmental risk of accidents when they happen. It should be acknowledged that, in the case of contingency plans, shipyard managements need to act in association with other relevant national and local emergency authorities and in accordance with national and international regulations.

The IMO International Convention on Oil Pollution Preparedness, Response and Cooperation (OPRC) requires member states to establish measures for dealing with oil pollution incidents, either nationally or in co-operation with other countries **[29]**.

In 2000, the parties of the OPRC convention adopted a protocol on Preparedness, Response and Co-operation to pollution incidents by Hazardous and Noxious Substances (HNS Protocol). The method by which these contingency plans are prepared and operated varies quite considerably between member states.

The shipyard managements are recommended to:

- cooperate with the relevant national and local authorities on the preparation of contingency plans for the shipyard area;

- have good knowledge of the existing contingency plans;

- communicate internally this knowledge; and

- assist in the coordination of contingency plans in case of an accident in the shipyard area.

4.1.2 Ship / Shipyard Interface

Shipyard managements stimulate environmentally friendly activities related to the ship/shore interface.

4.1.2.1 Ship waste management

Ships that are staying in shipyards may need to dispose of a variety of wastes produced during their journey or stay in the shipyard. Although International and European legislation create a general legal framework, it should be acknowledged that important variations can be observed in the national legislation of the member states.

Shipyard managements are recommended to:

- consult with interested parties;

- analyze the amounts and types of waste generated by ships using the shipyards;

- consider the type and capacity of facilities required;

- consider the location and ease of use of the facilities;

- ensure that the cost recovery systems for using port reception facilities provide no incentive for ships to discharge their waste into the sea;

- ensure that effective publicity is given to the facilities;

- submit a written plan to the competent authority; and

- review the planning process regularly.

4.1.2.2 Hazardous Material

Hazardous material used in the repair of ships (like asbestos or TBT paints) poses a special danger to the surrounding environment and community. The used material can harm the environment along the lifetime of the ship as well as while being scrapped.

The principal instrument is the International Convention for the Safety of Life at Sea (SOLAS), 1974 as amended which specifies the minimum standards for the construction, equipment and operation of ships, compatible with their safety **[30]**.

Recommended guidelines: The role of shipyard managements to reduce the risks posed by hazardous material will be the decisive authority on the ban of such material's usage, although it will cause a raise on the cost of the job done.

Shipyard managements are therefore recommended:

- to set up a ban-list of materials and make the procurement departments obey this by alternates created; and

- to exchange best practices between shipyards for alternative, environment-friendly products and systems.

4.1.2.3 Ship Emissions

MARPOL Annex VI sets regulations for the prevention of air pollution from ships, including designating special SO_x Emission Control Areas in the Baltic, the North Sea and the English Channel. The European Commission decided to go a step further by proposing a strategy to reduce air pollutant emissions (sulphur oxides, nitrogen oxides and volatile organic compounds) from the maritime sector, as well as an accompanying measure aimed to reduce the sulphur content in marine fuel oil.

4.1.2.4 Other Environmental Impacts from Shipyard Processes

Following list shows the main processes of shipbuilding and ship repair. Details of each process, methods used, inputs and outputs are detailed in Appendix-B. While realizing the environmental impact analysis of a certain shipyard, each process must

be observed in details, analyzed and fundamental risks to environment should be spotted.

- Painting
- Dry Abrasive Blasting
- Ultra High Pressure Water Jetting
- Metal Grinding
- Steel Fabrication
- Compressed Air
- Wastewater Treatment & Discharge
- Waste Management

4.2 Shipyards and Their Environmental Management

The environmental role of shipyard managements depends on national laws. In certain cases, national legislation already foresees environmental requirements for shipyard users. Environmental duties are also given to public authorities or administrations different from shipyard managements.

4.2.1 Laying the Groundwork for an environmental management system (EMS) - What is an EMS?

An environmental management system (EMS) is a management framework for reducing environmental impacts and improving organizational performance over time. EMSs provide organizations of all types with a structured approach for managing environmental and regulatory responsibilities to improve overall environmental performance, including areas not subject to regulation such as unregulated risk, resource conservation, and energy efficiency **[31]**. An EMS helps an organization better integrate the full scope of environmental considerations and get better results, by establishing a continuous process of checking to make sure environmental goals are met. The EMS approach is based on the concept of Total Quality Management (TQM), which was initially developed as a tool by the private sector to achieve higher and more consistent product quality. The framework is based on a plan-do-check-act continual improvement approach that leads an organization

through a regular cycle of planning, implementation, performance monitoring, and review/improvement.

With an EMS, an organization develops and routinely evaluates processes and procedures to identify and manage its environmental footprint. An organization looks at selected operations associated with its significant impacts and makes them visible, measurable, manageable and therefore subject to improvement. An EMS does not impose new technical requirements. Rather, it helps an organization develop its own short- and long-term environmental goals and objectives, its own operational controls, and its own improvement requirements. The EMS may lead an organization to adopt new methods, modify existing ones, or accept the practices it already has in place. The EMS framework can be adapted to support the needs, priorities, and circumstances of the implementing organization. Typically, an EMS is used to support continual improvement of activities relevant to environmental performance by helping an organization identify and act on opportunities for improvements.

An organization's decision about whether to implement an EMS, and potentially seek third-party certification (e.g., ISO 14001, EMAS) for it, is typically based on a comparison of the perceived costs and benefits. To pursue an EMS, organizations typically must decide that one or more of the following outcomes are important to business success:

• A strong environmental compliance management system that reduces the risk of non-compliance situations;

• An effective management system for driving environmental policy objectives through the organization, including into core operations;

• A system to support continual improvement of environmental management processes and performance; and

• A system that generates documentation for purposes of internal and/or external auditability.

In addition to organizations' desires to achieve one or more of these outcomes, there are other drivers that can shift the EMS decision dynamics, such as peer pressure within an industry sector, supply chain pressures or expectations, and the presence of incentives for pursuing an EMS.

In Appendix-A, sample procedures required for the development of an environmental management system are given. Each procedure, consisting of the purpose, affected activities, used forms, references, definitions, exclusions, procedures, general rules, frequency and records; forms a strong piece and the complete documentation complies with the needs and requirements of an environmental management system.

4.2.1.1 Potential Costs

Internal:

• Staff time (manager and other employees) (Note: Internal labor costs represent the bulk of the EMS resources expended by most facilities)

External:

• Possible consulting assistance

• Possible outside training of personnel

4.2.1.2 Potential Benefits

• Improved environmental performance

• Enhanced compliance assurance

• Prevention of pollution and resource conservation

• New customers/markets

• Increased efficiency/reduced costs

• Enhanced employee morale

• Enhanced image with public, regulators, lenders, investors

• Employee awareness of environmental issues and responsibilities

• Reduced risk

A recent U.S. National Aeronautics & Space Administration (NASA) study established a gold standard for measuring EMS implementation costs. NASA compiled implementation cost information at three centers piloting EMS, including estimates on in-house civil servant and contractor support. Though costs may be slightly different for a shipbuilding facility, the NASA costs range between $111 and $138 per capita with a range of hours spent from 1.3 to 2.3 per capita. The returns on

such investments tend to have two-year paybacks and can generate savings of about $3.50 for every dollar invested **[32]**.

4.2.1.3 "Plan, Do, Check, Act" Model

Some of the keys to a successful EMS include:

Top Management Commitment: Applying TQM principles to the environmental area and providing adequate resources are the job of top management. To initiate and sustain the EMS effort, top management must communicate to all employees the importance of:

• making the environment an organizational priority (thinking of effective environmental management as fundamental to the facility's survival);

• integrating environmental management throughout the facility (thinking about the environment as part of product/service and process development and delivery, among other activities); and

• looking at problems as opportunities to improve (identifying problems, determining root causes, and preventing problem recurrence).

Focus on Continual Improvement: No facility is perfect. The concept of continual improvement recognizes that problems will occur. A committed facility learns from its mistakes and prevents similar problems from recurring.

Flexibility and Simplicity: An effective EMS must be dynamic to allow the facility to adapt to a quickly changing environment. For this reason, EMS should be kept flexible and simple. This also helps make the EMS understandable for the people who must implement it to the facility's managers and other employees.

Compatibility with Organizational Culture: The EMS approach and a facility's culture should be compatible. For some facilities, this involves a choice: (1) tailoring the EMS to the culture or (2) changing the culture to be compatible with the EMS approach. Changing a facility's culture can be a long-term process. Keeping this compatibility issue in mind will help ensure that the EMS meets the facility's needs.

Employee Awareness and Involvement: As an EMS is designed and implemented, some roadblocks can be encountered. Some people may view an EMS as bureaucracy or extra expense. There also may be resistance to change or fear of new

responsibilities. To overcome possible roadblocks, it must be made sure that everybody understands why the facility needs an effective EMS, what their role will be, and how an EMS will help to control environmental impacts in a cost-effective manner. Employee involvement helps to demonstrate the facility's commitment to the environment and helps to ensure that the EMS is realistic and practical, and that it adds value.

Building or improving an EMS is an opportunity to assess how the shipyard manages environmental obligations and to find better (and more cost-effective) solutions. While some areas where your current EMS can be improved are probably be identified, this does not mean that things that are working well should be changed! By reviewing what the facility does and how well it works, it can be ensured that the EMS will be viable and effective, both now and in the future.

This section describes the 17 EMS elements that are common to most EMS models and notes the key linkages among these elements. While several good EMS models are available, in this study, ISO 14001 is used as a standard and a starting point for describing EMS elements **[33]**. This has been done for several reasons:

• ISO 14001 is a widely accepted international standard for EMS that focuses on continual improvement;

• Companies may be asked to demonstrate conformance with ISO 14001 as a condition of doing business in some markets **[34]**.

4.2.1.4 Management Review

The elements of an EMS are listed below which are not necessarily arranged in the order presented in the ISO 14001 Standard.

(1) Structure and responsibility – Establish roles and responsibilities for environmental management and provide appropriate resources.

(2) Environmental policy – Develop a statement of the facility's commitment to the environment. Use this policy as a framework for planning and action.

(3) Legal and other requirements – Identify and ensure access to relevant laws and regulations, as well as other requirements to which the facility adheres.

(4) Environmental aspects – Identify environmental attributes of the products,

activities, and services. Determine those that could have significant impacts on the environment.

(5) Objectives and targets – Establish environmental goals for the facility, in line with the policy, environmental impacts, the views of interested parties, and other factors.

(6) Environmental management program(s) – Plan actions necessary to achieve the objectives and targets.

(7) Training, awareness, and competence – Ensure that the employees are trained and capable of carrying out their environmental responsibilities.

(8) Communication – Establish processes for internal and external communications on environmental management issues.

(9) EMS documentation – Maintain information on the EMS and related documents.

(10) Document control – Ensure effective management of procedures and other system documents.

(11) Operational control – Identify, plan, and manage the operations and activities in line with the policy, objectives, and targets.

(12) Emergency preparedness and response – Identify possible emergencies and develop procedures for preventing and responding to them.

(13) Monitoring and measurement – Monitor key activities and track performance. Conduct periodic assessments of compliance with legal requirements.

(14) Non-conformance and corrective and preventive action – Identify and correct problems and prevent their recurrence.

(15) Records – Maintain and manage records of EMS performance.

(16) EMS audits – Periodically verify that the EMS is operating as intended.

(17) Management review – Periodically review the EMS with an eye to continual improvement.

A "Gap Analysis Tool/Self Assessment Checklist" has been given in Appendix-C to be used for the control of all needed steps of a true Environmental Management System **[10]**.

4.2.2 Environmental Policy

Environmental Policy Template: It is the policy of [Shipyard's Name] to conduct its operations in a manner that is environmentally responsible and befitting of a good corporate neighbor and citizen. In accordance with this policy, [Shipyard's Name] complies with all environmental laws and manages all phases of its business in a manner that minimizes the impact of its operations on the environment. To further this policy, [Shipyard's Name] shall:

(1) Comply with applicable environmental laws and regulations and voluntary commitments to which the facility subscribes.

(2) Eliminate, or reduce to the maximum practical extent, the release of contaminants into the environment, first through pollution prevention (material substitution and source reduction), then recycling, and finally through treatment and control technologies.

(3) Effectively communicate with facility employees, suppliers, regulators, and customers, as well as the surrounding community, regarding EMS performance.

(4) Periodically review and demonstrate continuous improvement in the facility's environmental performance, including areas not subject to regulations.

4.2.3 EMS Responsibilities in organizational structure

One of the first tasks of EMS planning is to establish the roles and responsibilities associated with EMS leadership and technical support. Closely related task of creating an ongoing structure that ensures the facility is equipped with sufficient personnel and other resources to meet its objectives and targets and to ensure compliance with legal requirements are described below. The facility should also provide appropriate incentives for personnel to meet the EMS requirements.

4.2.3.1 Assigning Responsible People

It is important to designate, as soon as possible, the Environmental Management Representative (EMR), the EMS Coordinator, and the Cross Functional Team (CFT), all of whom will play a role in developing and promoting the EMS. If it is a very small facility, these may all be the same person. However, it is still important to designate who will be responsible for various activities.

• The EMR is the member of the facility's top management who is responsible for the functioning of the EMS. The EMR ensures that all tasks relating to the EMS are identified and completed in a timely manner. The EMR is responsible for reporting periodically to top management on the progress and results of the EMS.

• The EMS Coordinator is responsible for identifying, assigning, scheduling, providing the necessary support for, and ensuring completion of all tasks relating to the EMS. The EMS Coordinator works closely with the EMR and the CFT. The EMS Coordinator is also responsible for maintaining the EMS manual, under the leadership of the EMR. It is possible for the functions of EMS Coordinator and EMR to be performed by the same person.

• The CFT includes members of the facility who are responsible for representing their area or department in several facets of the EMS, such as identifying environmental aspects, determining significant environmental aspects, setting objectives and targets, implementing environmental management programs, reviewing and tracking EMS internal audits results, and serving as an information resource. The CFT meets to discuss the EMS on a regular basis.

In assigning EMS responsibilities and creating the EMS team, it is crucial that the range of job functions and skills that make up the facility are explored, and people who will dedicate themselves to the EMS tasks are selected from that broad spectrum of. To do that, the facility's structure is considered, then a list of job functions and skills that make up the facility to support the EMS planning and implementation efforts is printed.

4.2.3.2 EMS Implementation Training

The efforts of the EMS Team (the EMR, the EMS Coordinator, and the CFT) will be crucial to effective EMS implementation and the long-term success of the facility's EMS. In-depth training on how to plan and implement an EMS and integrate it with existing facility operations is required so that the EMS Team conducts itself effectively and efficiently. Usually this implementation training precedes other activities, such as drafting an environmental policy, reviewing environmental compliance requirements, identifying environmental aspects, and other planning and implementation tasks. Functions and roles of shipyard staff regarding environmental management system study are given in Table 4.3.

Table 4.3: Functions and roles of shipyard staff on EMS.

Facility Function	Expertise Brought to Project Team	How They Can Help (Possible Roles)
Top Management	- Capability for ensuring continual improvement	Communicate importance of EMS throughout the facility; provide necessary resources; review EMS performance.
Environmental	- System for complying with environmental regulations - Management of records	Provide an organizational and functional role in establishing and maintaining the EMS.
Production	- Management of environmental aspects of production	Help identify significant environmental aspects; provide input to objectives and targets; participate in environmental management programs; serve as trainers and internal auditors; help carry-out corrective and preventive action.
Maintenance	- Management of environmental aspects of equipment maintenance	Implement preventive maintenance program for key equipment; support identification of environmental aspects.
Facilities Engineering	- Management of environmental aspects of new construction and installation of equipment	Consider environmental impacts of new or modified products and processes; identify pollution prevention opportunities.
Human Resources	- Knowledge of training programs (including environmental) - Experience with the inclusion of employee incentives in performance measurement system	Define competency requirements and job descriptions for various EMS roles; train temporary workers and contractors; maintain training records; integrate environmental management into reward, discipline, and appraisal systems.
Purchasing	- Knowledge of procurement system (including screening of suppliers, material composition of components)	Develop and implement controls for chemical/other material purchases and for communicating requirements to contractors and suppliers.
Accounting / Finance	- Systems for tracking costs of operations and evaluating cost/benefits of new projects	Track data on environmental-related costs (such as resource, material, energy and waste disposal costs, etc.); prepare budgets for environmental management programs; evaluate economic feasibility of projects.
Operations Personnel / All Employees	- Thorough knowledge of processes and operations	Provide first-hand knowledge of environmental aspects of their operations; support training for new employees.
Quality	- Quality management system, including document control procedures	Support document control, records management and employee training efforts; support integration of environmental and quality management systems.
Shipping, Receiving, Transportation and Logistics	- Management of environmental aspects of shipping, receiving, and transportation	Help identify aspects; provide input to objectives and targets; participate in environmental management programs; serve as trainers and internal auditors; help carry out corrective and preventive action.
Sales / Marketing	- Knowledge of environment-related commitments to customers	Assist with communications with external stakeholders.
Public Relations	- System for communicating with public on environmental issues	Assist with communications with external stakeholders.
Product / Process Design	- System for examining environmental aspects of new designs	Participate in product-related objectives, targets, and EMPs.
Storage / Inventory	- Management of environmental aspects of raw material and product storage.	Help identify aspects; provide input to objectives and targets; participate in environmental management programs.

4.2.3.3 EMS Responsibilities Descriptions

[Shipyard's Name] needs to establish an Environmental Management System (EMS) Team made up of the following members: an Environmental Management Representative (EMR), an EMS Coordinator, and a Cross Functional Team (CFT). Responsibilities of each are as follows:

• Environmental Management Representative. The EMR is the member of [Shipyard's Name] top management responsible for the functioning of the EMS. It is his or her job to ensure that all tasks relating to the EMS are identified and completed in a timely manner. He or she is also responsible for reporting periodically to top management on the progress and results of the EMS.

• EMS Coordinator. The EMS Coordinator's responsibility is to identify, assign, schedule, provide the necessary support for, and ensure completion of all tasks relating to the EMS. The EMS Coordinator works closely with the EMR and the CFT. The EMS Coordinator is also responsible for maintaining this EMS manual, under the leadership of the EMR. The same person may fill the functions of EMS Coordinator and EMR.

• Cross Functional Team. The CFT is made up of members of the facility who are responsible for representing their area or department in several facets of the EMS, such as establishing environmental aspects, determining significant aspects, setting objectives and targets, implementing environmental management programs, reviewing and tracking EMS internal audits results, and serving as an information resource. The CFT meets to discuss the EMS on a regular basis.

Other management personnel also play a crucial role in the structure and function of the EMS at [Shipyard's Name].

4.2.3.4 Records

The EMS Coordinator maintains an updated list of the EMR, the EMS coordinator, and CFT members. A letter issued by top management that assigns the current EMR and his or her responsibilities is maintained as part of this facility's EMS manual and is attached to the EMS Responsibilities Form.

4.2.4 Objectives and Targets

Objectives and targets help a facility translate purpose into action. These environmental goals should be factored into the business plans. This can facilitate the integration of environmental management with the facility's other management processes.

An environmental objective is an overall environmental goal, arising from the environmental policy, that a facility sets itself to achieve and which is quantified where practicable. An environmental target is a detailed performance requirement, quantified where practicable, applicable to the facility or parts thereof, that arises from the environmental objectives and that needs to be set and met to achieve those objectives.

It is determined what objectives and targets are appropriate for the facility. These goals can be applied facility-wide or to individual units, departments, or functions, depending on where the implementing actions will be needed.

In setting objectives, the environmental policy commitments must be kept in mind. Also the significant environmental aspects (SEAs), applicable legal and other requirements, the views of interested parties, the technological options, and financial, operational, and other organizational considerations should be considered, including:

• The ability to control;

• The ability to track/measure;

• The cost to track/measure; and

• Progress reporting.

4.2.4.1 Considerations for Developing Objectives and Targets

Considerable facts on objective and target development are given in Figure 4.1. Each item should be assessed and taken into consideration before finalizing the object development.

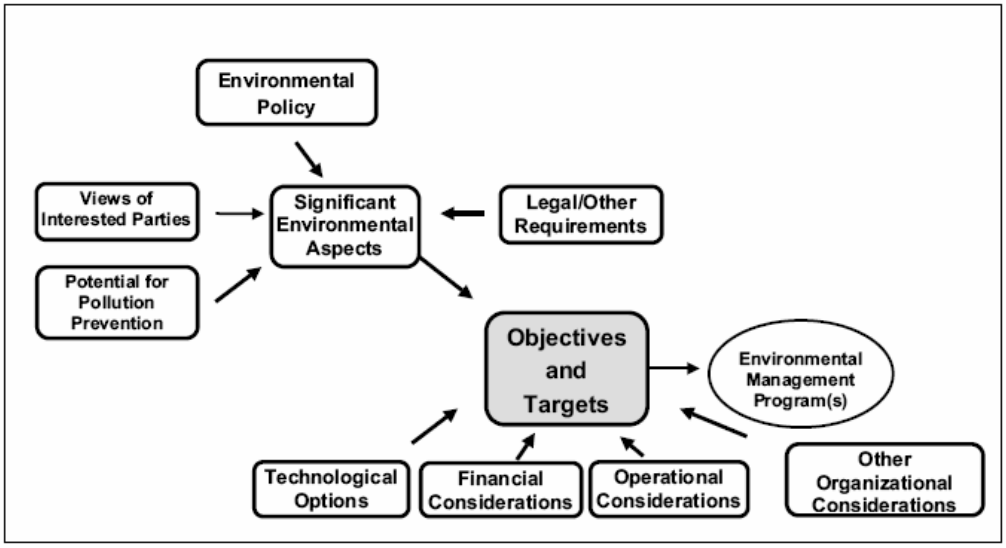

Figure 4.1: Objective and Target development

Here are some things to think about to expedite the determination of the facility's environmental objectives and targets:

• Involve people in the relevant functional area(s) when setting objectives and targets. These people should be well positioned to establish, plan for, and achieve these goals. By involving people you help to build commitment.

• Get top management buy-in for your objectives. This will help to ensure that adequate resources are applied and that the objectives are integrated with other organizational goals.

• Link the objectives to the actual environmental improvements being sought when communicating objectives to employees. This should give people something tangible to work towards.

• Ensure that the objectives are consistent with the overall mission and plan and the key commitments established in the policy (pollution prevention, continual improvement, and compliance). Targets should be sufficiently clear to answer the question, "Did we achieve our objectives?"

• Be flexible in the objectives. Define a desired result, then let the people responsible determine how to achieve the result.

• Establish objectives to maintain current levels of performance or compliance as well as to improve performance. For some SEAs you might have both maintenance and improvement objectives.

• Communicate your progress in achieving objectives and targets throughout the facility. Consider a regular report on this progress at staff meetings or posting key targets and progress toward them in the facility.

• Consider holding an open house or establishing a focus group with people in the community to obtain the views of interested parties.

• Keep the objectives simple initially, gain some early successes, and then build on them. How many improvement objectives and targets should a facility have? Various EMS implementation projects indicate that it is best to start with a limited number of improvement objectives (say, three to five) and then expand the list over time.

• Make sure the objectives and targets are realistic. Determine how you will measure progress towards achieving them.

• Keep in mind that the suppliers (of service or materials) can help in meeting the objectives and targets (e.g., by providing more "environmentally friendly" products).

• Know that if an environmental aspect is not significant then it does not need an objective and target.

4.2.4.2 Pollution Prevention Tools

As interest in pollution prevention grows, it becomes increasingly important to find ways to evaluate the potential benefits of pollution prevention alternatives. Two such tools are Life Cycle Analysis (LCA) and Total Cost Assessment (TCA).

LCA generally focuses on the environmental aspects of a specific product, although it could be applied to processes or services, over its lifetime. LCA looks at each stage, from raw material through production, use, and disposal. Inputs to the analysis include energy use, waste generation, emission, and releases from each stage.

TCA focuses on the total costs of a project or product, including environmental costs, which many assessment methods do not include. This is often done to support evaluations of process or product changes over the long-term. For example, TCA might be used to assess the benefits and costs of continuing to use a VOC-based process versus those of using a water-based process for the same purpose.

4.2.4.3 Objectives - Targets

Samples of objectives and targets are given and defined below in order to express some opinion.

Supplies

• Increase use of suppliers that provide alternative chemicals by 15% by August 2006

• Implement recycling of supplies (abrasive media, oil, plastic, laser cartridges, metal, and paint booth water) by August 2006

• Implement reuse program for wooden pallets by August 2006

Chemicals

• Reduce use of high-VOC paints by 25% by August 2006

• Increase use of water-soluble cutting fluids by 15% by August 2006

Energy Use

• Reduce electricity use by 10% by August 2006

• Reduce natural gas use by 15% by August 2006

Water Use

• Reduce water use by 10% by August 2006

Air Emissions

• Reduce boiler emissions by 10% by August 2006

• Improve material handling practices (for example, use of paint warming cabinets) by August 2006

• Improve paint use tracking system by August 2006

• Reduce paint overspray by 25% by August 2006 by training personnel on correct spray painting techniques and developing maintenance program for spray painting equipment to allow maximum transfer efficiency (to be supported by paint vendor)

Water Discharges

• Increase use of aqueous cleaners by 20% by August 2006

• Restore fish stocks and habitat by August 2006

Solid/Liquid Wastes

• Reduce paint waste by 25% by paint mixing at point of use by August 2006

• To be achieved by target above and reduction of hazardous chemicals use

Stormwater Discharges

• Improve stormwater collection and filtration system by August 2006

• Investigate effectiveness of additional best management practices by August 2006

Spills

• Reduce spill occurrence by 10% by August 2006 by conducting the following training: (1) all plant personnel will receive awareness training during 2006; (2) all raw material handling personnel will receive spill prevention training during 2006; and (3) all production personnel will receive spill control training to reduce spills that exit the plant during 2006. Also, the Cross Functional Team will develop a team to conduct a root cause analysis of spills during 2006 that will be incorporated into the training program.

4.2.5 Improvement Program – Monitoring and Measurement

An EMS without effective monitoring and measurement processes is like driving at night without the headlights on - you know that you are moving but you can't tell where you are going. Monitoring and measurement helps to:

• Measure environmental performance;

• Analyze root causes of problems; and

• Assess compliance with legal requirements.

In short, monitoring and measurement helps to manage the organization better. The results of pollution prevention and other efforts are easier to demonstrate when current and reliable data are available. These data can help to demonstrate the value of the EMS to top management.

The facility should develop means to:

• Monitor key characteristics of operations and activities that can have significant environmental impacts and/or compliance consequences;

• Track performance (including the progress in achieving objectives and targets);

• Calibrate and maintain monitoring equipment; and

• Periodically evaluate the compliance with applicable laws and regulations through internal audits.

4.2.5.1 Tracking Performance

To have a successful EMS, it is important to determine program measurement criteria. Determining measurement criteria, also called performance indicators, will help to evaluate the success of the overall EMS program. Performance indicators measure overall success, while key characteristic indicators measure progress against EMS objectives for specific significant environmental aspects (SEAs). The following are examples of EMS results performance indicators for the EMS or various program components that can be tracked over time:

• Number of SEAs included in environmental projects plan;

• Number of environmental objectives and targets met;

• Pounds of hazardous waste generated per unit of production;

• Employee sick leave absences related to work environment;

• Percentage of employees completing environmental training;

• Average time for resolving corrective action;

• Energy or water use per unit of production;

• Percentage of solid waste recycled/reused;

• Number of complaints from community and/or number of responses to complaints;

• Number of pollution prevention ideas generated by employees;

• Resources used per unit of product or service;

• Pollution (by type) generated per unit of product or service;

• Percentage of products for which life cycle assessment has been conducted;

• Number of products that have a recycling program; and

• Number of instances of non-compliance.

It is the results shown by these environmental performance indicators that will become the basis for the plans for next year and for documenting continuous

improvement.

The purpose of these indicators is different from the specific measurement criteria developed for evaluating progress toward individual objectives. These performance indicators focus on how well the overall system for improving environmental management is functioning. Select performance indicators that will help to decide whether success has been achieved or whether improvement in procedures needs to be made.

One approach is to measure the actions, for example, number of meetings held with stakeholders, number of documents created, number of employees trained, or number of hours of training. Action, however, does not always mean results. Consider the objective of each EMS component and define a way to measure results.

To measure results effectively, the methods should be:

• Simple;

• Flexible;

• Consistent;

• Ongoing;

• Produce reliable data; and

• Communicate results.

4.2.5.2 Measuring Improvement in Pollution Prevention

Measuring pollution prevention achievements is part of tracking performance, but may be different from, and often more difficult than, measuring environmental achievements in general. Simply measuring the reduction in a waste stream might mean only that the waste has been transferred to another medium, not reduced. It is therefore important to measure the reduction at the source of waste generation.

In addition, administrative procedures can be established to support pollution prevention activities. The facility should consider:

• Establishing procedures in each facility area for identifying pollution prevention opportunities;

• Having a chemical or raw material inventory system in place; and

• Assessing how many objectives have been met through pollution prevention.

4.2.5.3 Calibrating Equipment

A component of monitoring and measurement is equipment calibration. The facility should identify process equipment and activities that affect the environmental performance.

Some facilities place critical monitoring equipment under a special calibration and preventive maintenance program. This can help to ensure accurate monitoring and make employees aware of which instruments are most critical for environmental monitoring purposes. Some facilities find it is more cost effective to subcontract calibration and maintenance of monitoring equipment than to perform these functions internally.

4.2.5.4 Corrective and Preventive Action

No EMS is perfect. Probably the problems with the system will be identified through audits, measurement, or other activities. In addition, the EMS will need to change as the facility adapts and grows. To deal with system deficiencies, the facility needs a process to ensure that:

• Problems (including nonconformities) are identified and investigated;

• Root causes are identified;

• Corrective and preventive actions are identified and implemented; and
• Actions are tracked and their effectiveness is verified.

EMS nonconformities and other system deficiencies, including legal non-compliance, should be analyzed to detect patterns or trends. Identifying trends allows you to anticipate and prevent future problems.

4.2.5.5 Environmental Records

The purpose of records management is simply to help to demonstrate that the facility is actually implementing the EMS as designed. While records have value internally, also it may needed to provide them to external parties (such as customers, a registrar, or the public), as evidence of EMS implementation. Records management is sometimes seen as bureaucratic, but it is difficult to imagine a system operating consistently without accurate records.

Records provide evidence that the processes that make up the EMS are being implemented as described. The basics of records management are to decide which records to be kept, how to be keep them, and for how long.

If the facility has an ISO 9001 (or other) management system, it should already have a process in place for managing records. This process could be adapted for EMS purposes.

4.2.5.6 EMS and Regulatory Compliance Audits

Once the facility has established its EMS, it is crucial to assess whether it is suitable and adequate and to ensure planned arrangements for the EMS are being followed. It is relatively easy to create a system that works well in the absence of change; the more difficult challenge is to have in place a system that meets its commitments when faced with dynamic business conditions. EMS audits are pivotal to maintaining a viable system in the face of accidents, emergencies, changing rules, staff turnover, etc.

For the EMS audit program to be effective:

• Develop audit procedures and protocols;

• Determine an appropriate audit frequency;

• Select and train the auditors; and

• Maintain audit records.

Results of the EMS audits should be linked to the corrective and preventive action process.

While they can be time-consuming, EMS audits are critical to EMS effectiveness. Systematic identification and reporting of EMS deficiencies to management provides a great opportunity to:

• maintain management focus on the environment;

• improve the EMS and its performance; and

• ensure the system's cost-effectiveness.

4.2.5.7 Environmental Management System Management Review

Just as a person should have periodic physical exams, the EMS must be reviewed

periodically to stay "healthy." Management reviews are critical to continual improvement and ensure that the EMS will continue to meet the facility's needs over time.

The goal of the review should be to allow management to bring about overall improvements. The scope and frequency of the review should depend upon the size and complexity of the facility and other factors that are determined relevant in each organization.

To maintain continual improvement, suitability and effectiveness of the EMS and thereby its performance, the facility's top management should review and evaluate the EMS at defined intervals, such as quarterly.

The scope of the review should be comprehensive, though not all elements of the EMS need to be reviewed at once. The review process may take place over a period of time. Review of the policy, objectives, and procedures should be carried out by the level of management that defines them. Some items to include in the management review include:

• results from assessments;

• the extent to which objectives and targets have been met;

• the continuing suitability of the EMS in relation to changing conditions and information; and

• concerns among relevant interested parties.

4.2.6 Self Assessment

At the end of the implementation period of an environmental management system, it is better to establish a self assessment of the system implemented. A detailed self assessment checklist is included in Appendix-C for further development.

4.3 Identification of Legal Requirements

Compliance with legal requirements is one of the main pillars upon which the environmental policy should be based because the potential costs of non-compliance (possible damage to the environment, revenue loss and impact on public image, for example) can be very high.

An effective EMS will build on what already is and should include processes to:

• identify and communicate applicable legal and other requirements; and

• ensure that these requirements are factored into the facility's management efforts.

New or revised legal requirements might require modification of the environmental objectives or other EMS elements. By anticipating new requirements and making changes to the operations, some future compliance obligations and their associated costs might be avoided.

Furthermore, national legislation can vary for different countries. For instance, Japan appears to have established environmental policies designed to protect human health and the natural environment. Various laws such as the Air Pollution Control Law, the Water Pollution Control Law and the Chemical Substances Control Law provide the basis for establishing standards on waste releases. Under these laws, environmental standards were established for maintaining ambient air and water quality, and preserving the natural environment in Japan. It is important to note that Japan gives highest priority to environmental impact assessments and environmental Based on the regulations reviewed in this paper, it is hard to get a clear picture on the impact of the environmental standards on shipyards, and the level of environmental compliance by the Japanese shipyards. However, because of the complex processes and chemicals employed in shipyards, it is reasonable to expect that Japanese shipyards are strictly regulated under the current environmental laws **[35]**.

4.4 Integration of Environmental Management Systems and Quality Management Systems

Integrating management systems has become an increasingly important competitive issue. A growing body of information indicates that facilities that integrate their environmental management system (EMS) and quality management systems (QMS) can realize significant benefits, such as streamlined operations and decision-making, simplified employee training, more efficient use of resources, and a reduction in audit costs. Systems for managing health and safety and other organizational functions can be similarly integrated **[36]**.

The two most common models for QMS and EMS (ISO 9001 and ISO 14001, respectively) share many common elements. This should be no great surprise,

because ISO 9001: 1994 was one of the source documents used by the drafters of ISO 14001. The two standards are very compatible in their current forms. The ISO committees responsible for the development and maintenance of these two standards continue to examine potential opportunities to increase the compatibility or alignment of the two standards.

Facilities that choose to implement both of these standards generally find that they can use many common processes to conform. In general, the elements of a QMS and EMS can be categorized as either (1) essentially the same, (2) similar, or (3) unique System elements in both the "essentially the same" and "similar" categories can often be addressed by a common procedure (or parallel procedures), although some customization may be needed to address the differing overall purposes of these systems. Unique elements are typically dealt with in separate EMS or QMS procedures. Some of the typical elements for integration include: document control; corrective/preventive action; training; records management; and management review. However, some facilities have gone much further—for example, some have developed common quality and environmental policies. The degree of system integration varies widely from facility to facility.

While an EMS can be readily integrated with an existing QMS, the overall purposes of these two systems must be kept in mind. A QMS is intended primarily to ensure that a facility satisfies its customers by assuring the quality of its products. An EMS generally has a broader context—the relationship between a facility and the environment in which it operates. Also, an EMS often concerns itself with a broader range of stakeholders, such as neighboring communities, customers, and regulatory agencies.

System integration can have environmental benefits. By linking environmental management more closely with day-to-day planning and operation, some facilities have been able to raise the visibility of environmental management as a core organizational issue. In addition, these facilities enhance their abilities to address environmental issues when making modifications to products or processes for quality purposes.

Facilities that have a QMS in place generally are better off when implementing an EMS for several reasons. First, employees typically are already familiar with management system concepts and are involved in making the system work. Second,

many of the processes needed for the EMS might already be in place. Finally (and perhaps most importantly), top management has committed the use of management systems to achieve facility goals.

Another related and important, yet largely untapped, question is whether by IMS we mean the integration of standards **[37]**, internal management systems **[38,39]**, or both. If we adopt the first definition, the ultimate result would be a single and truly generic management system standard, possibly covering all disciplines and functions within an organization and probably be applicable to different establishments in different sectors. But such sort of a study would need excessive amounts of professional effort. On the other hand, companies can easily proceed with or without such an integrated standard by interpreting the existing function-specific standards and establishing their own Integrated Management System.

4.4.1 Joint sides of Management Systems

The common elements of the mentioned systems are **[40]**:

- the same interest groups (employees, management, business partners, people, state, stockholders)
- the same organization and environment processes
- the same methods and techniques, management theories and practice
- similar concepts of process management
- similar concepts of resource management
- the same management, analysis and improvement concepts
- the same management responsibility
- the same organization vision, mission and business concepts

Additionally, the common denominators of the management systems are;

- Management processes – management review, human resources management, infrastructure and work environment,
- Documentation process – Control of documents and records,
- Customer / interested parties process
- Product / Service realization process

- Purchase process / supplier relationship process
- Monitoring and measurement process
- Continual improvement process – nonconforming product, corrective & preventive actions
- Control of emission and effluents / solid waste management process
- Incident management and emergency management process

4.4.2 Tips on System Integration

For facilities that have an existing QMS and wish to integrate an EMS with it, some tips are provided below.

• Understand the existing QMS, its effectiveness, and how the work force perceives the system. Is the existing QMS documentation clear and workable? Do employees believe that the system is helping the facility to achieve desired results?

• Ensure that the scope of the two systems will be consistent (i.e., that the systems will cover the same facilities, products, activities, and/or services). In particular, this will be an important issue if third-party registration will be sought.

• Establish a Cross Functional Team (including, at a minimum, representatives from the environmental and quality functions) to determine the optimal approach to system integration.

• Manage resistance to change as needed. Some employees and managers may be reluctant to change a system with which they are already familiar and/or in which they have important roles.

• Understand how QMS and EMS differ in purpose. While there are many common management system elements, there are elements of each system that are unique. In the case of EMS, these include, for example, environmental aspects, communications and emergency preparedness and response. These differences must be acknowledged and accommodated within the integrated management system.

• Modify system documentation as required. Keep procedures simple and clear for users. Review proposed changes with affected managers and employees.

• Consider whether to integrate procedures or keep them separate on a procedure-by-procedure basis. While integration can reduce the total number of procedures or work

instructions, it also can confuse the overall purpose of such procedures, in some cases.

• Train managers and employees on the integrated system once the integrated system documentation has been prepared.

• Audit the integrated system and take actions as necessary.

4.4.3 Final Thoughts on System Integration

Integration of two or more management systems is an economically and systematically logical, as long as you do not have reasonable answers for the following questions:

• Can your facility afford to have two or more separate systems?

• Are there compelling reasons to keep these systems separate?

• What is the optimal approach from a strategic and operational standpoint?

• Which approach is best suited for the facility's change and growth?

5. CONCLUSION

The total cost of processes handled in order to fulfill the requirements of both national and international environmental legislation, results in an increasing amount day by day. Both states and international organizations are in a race of putting sanctions into motion about environmental care and protection.

Mostly affected bodies from the toughening legislations are the industrial enterprises, especially the heavy industries having various environmental aspects. As the shipbuilding and repair industry is one of them, negative influences of new codes and directives show noteworthy effect on the market share of ones which are faced with tighter legislation. As commercial shipbuilding and repair operates in a global market, with yards competing for contracts outside their own countries, comprehensive exposure to different legislative forces makes shipbuilding absolutely different from most other industries. While a strong state-based discipline exists in the EU, no specific discipline applies at international level, especially in far-eastern countries.

In conclusion, the shipbuilding sector is practically the only industry without effective protection against unfair trading practices. Consequentially, the need for optimizing the cost due to environmental legislation has arisen. The best practice for the minimization of costs without facing with penalties is developing a management system, which is both a guarantee for the continuation of the system and a tool for optimizing the job done.

An environmental management system, once to be seen luxury for most enterprises, is an indispensable tool to cope with the environmental legislation. The system both eases the prosecution, reduces risks, provides continual improvement and obtains noteworthy decrease in the cumulative running costs.

The implementation period of an environmental management system differs from case to case, for different sizes of organizations, various scopes of production and dynamism. But on the implementation process, the most important fact is the

managerial commitment. If the management can persuade the working team on the need of the system, the implementation phase will be painless.

Another tool for the application of an environmental management system this time, is implementing an integrated management system, by combining quality and environmental issues. As all management systems share a lot of common practices, the integration will make the record-keeping, audit, review and some other processes much easier.

As a result of these, in order to cope with the rapidly arising environmental legislation both nation-wise and internationally, implementation of an environmental management system is an indispensable tool for shipyard managements, both for the continuation of productivity and competitive position in the world market.

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APPENDICES

Appendix-A – Sample Procedures for EMS Implementation

Table A.1: Sample Procedure for Environmental Aspects, Objectives and Programs

Procedure for Environmental Aspects, Objectives and Targets and Programs

1.0 Purpose

This procedure defines [Shipyard's Name]'s method for the identification of environmental aspects of its operations and the determination of significance for aspects that have actual or potential significant impacts on the environment.

2.0 Activities Affected

All areas and departments

3.0 Forms Used

3.1 Identification and Significance Determination of Environmental Aspects and Setting
Objectives and Targets

3.2 Environmental Management Programs

4.0 References

4.1 Procedure for Environmental Management System Management Review

4.2 Procedure for Emergency Preparedness and Response

4.3 Procedure for Identification of Legal and Other Requirements

4.4 Procedure for Communication with Stakeholders

4.5 Procedure for Environmental Training and Awareness

4.6 Procedure for Monitoring and Measurement

4.7 ISO 14001:1996, Elements 4.3.1, 4.3.3 and 4.3.4

5.0 Definitions

5.1 Environmental Aspect: element of an organization's activities, products or services that can interact with the environment.

5.2 Environmental Objective: overall environmental goal, arising from the environmental policy, which an organization sets itself to achieve and which is quantified where practicable.

5.3 Environmental Target: detailed performance requirement, quantified where practicable, applicable to the organization or parts thereof, which arises from the environmental objectives and which needs to be set and met to achieve those objectives.

5.4 Environmental Management Program: the means, time frames, and personnel responsible for achieving an objective and target.

6.0 Exclusions

None.

7.0 Procedures

7.1 Procedure for Environmental Aspect Identification

7.1.1 The facility Cross Functional Team (CFT), led by the Environmental Management Representative (EMR) or designee, is responsible for completing the Identification and Significance Determination of Environmental Aspects and Setting Objectives and Targets (Aspects Form) for each core process and supporting activity.

If possible, members of the CFT will conduct a physical inspection when completing the form. The completed form is a process flow diagram of a process or activity and is used to identify environmental aspects.

7.1.2 At a minimum, the CFT will review and revise the completed forms, by means of physical inspection, as necessary at issuance, annually, and before and immediately following implementation of new or modified processes/activities.

7.1.3 All environmental aspects are evaluated for significance as defined in the section below, Procedure for Determination of Significant Environmental Aspects.

7.1.4 The following procedure is used to fill out the Aspects Form.

7.1.5 Creating the process flow diagram consists of identifying all raw materials, chemicals, and utilities used as inputs and all outputs produce as products and by-products. Outputs are all products, wastes produced, recycled materials, water discharges, and air emissions known for the process(es).

7.1.6 When identifying inputs and outputs, all modes of operation will be considered because start-up, shutdown, or emergency operations might introduce additional aspects to the process. When doing the diagrams, the team will make notes of other potentially useful information such as the quantity or volume used per unit time, where available. These diagrams will be improved over time with specific data to allow material balances in the long term, if this is not possible initially. To assist with these diagrams, the CFT shall consider the following potential inputs and outputs:

• Inputs

• Supplies: Enter the major, non-chemical supplies used in the process.

• Chemical: Enter any chemical materials used in the process.

• Energy Use: Enter energy type and usage. (Levels are relative to the facility.)

• Water Use: Enter water type (e.g., city, well, storm, process, chilled) and usage. (Levels are relative to the facility.)

• Other Inputs: Enter inputs that are not covered clearly in other categories.

• Outputs

• Air Emissions: List all air emissions whether they are drawn directly through a stack or are discharged into the room and escape as fugitive emissions.

• Noise/Odor/Radiation: Include noise and odor as an air emission if potentially noticeable outside the facility and list any potential radiation emitted from the facility.

• Water Discharges: Enter all wastewater streams that discharge directly to

storm or sanitary sewer systems or surface waters. Containerized wastewater should be included in the waste section.

• Solid/Residual Wastes: Wastes are any materials intended to be discarded or disposed of, whether regulated or not, and include liquids, solids, and gases. Also include recycled materials, returnable containers, and chemical by-products under this category.

• Stormwater Discharges: List all stormwater discharges from all process areas.

• Spills: Enter all potential spills that might occur in all process areas.

7.2 Procedure for Determination of Significant Environmental Aspects (SEAs)

7.2.1 Where appropriate, individual aspects can be grouped. For example, if the consumption of energy is listed as an environmental aspect in several areas, the CFT can group these listings such that consumption of energy appears just once on a facility-wide form.

7.2.2 The following criteria will be used to determine significance and are listed in the Aspects Form:

1. Legal Requirements/Voluntary Commitments/Company Policy: Subject to specifically relevant legislation, regulation, and/or permit requirements that address significant impacts to the environment. This will likely include aspects associated with processes and activities if (1) environmental regulations specify controls and conditions, (2) information must be provided to the authorities, and/or (3) there are, or may be, periodic inspections or enforcement actions taken by the authorities. Potential aspects that are subject to environmental regulations in the event of incidents will be recognized as significant when such an event occurs. A closely related condition is whether an aspect is the subject to or associated with environmentally-related facility goals, directives, policies, or subject to or associated with voluntary covenants to which the facility had committed.

2. Community Concern: Subject to or associated with community concerns, such as those previously expressed in the form of complaints or critical inquiry.

3. Pollution Prevention Potential: Based on technical and business conditions, has a high potential for pollution prevention or resource-use reduction.

4. Potential Impact to the Environment: Associated with potential impact to the environment from high environmental loading due to one or more of the following:

a. Toxicity (compositional characterization of materials and wastes)

b. Amounts (volumes and masses of emissions, waste, or releases)

c. Amounts (consumption of renewable and non-renewable resources)

d. Frequency of episodes

e. Severity of actual or potential impacts

7.3 Establishing and Maintaining Objectives and Targets

7.3.1 The CFT shall establish and maintain environmental objectives and targets for all significant aspects. Objectives and targets shall be consistent with the [Shipyard's Name] environmental policy and shall be one of three types: control; improve; or investigate. The environmental objectives and targets for each process shall be recorded using the last two columns of the Aspects Form for each process. For each SEA, the organization will establish an appropriate

objective and target.) There are three types of objectives represented as follows:

C = Control or Maintain I = Improve S = Study or Investigate

Guidance regarding use of these objectives is provided below for use by the CFT:

• Control or Maintain–is an appropriate objective for SEAs that are the subject of environmental regulations because the environmental policy states that we will comply with the law. In these cases, the objective will be to maintain conformance with operational controls, such as procedures and work instructions that apply to those significant aspects. The target will be ongoing.

• Improve–is appropriate for SEAs that our facility goals commit us to improving upon. For example, energy- or water-use reductions that are not required by law but fall within our commitment to pollution prevention. Improvement objectives also can be used for SEAs that have regulatory drivers and environmental improvement goals. For example, we have regulatory requirements and fugitive emission reduction goals for our VOC emissions. Copper in storm water effluent is another example because we wish to reduce discharge levels below the limits set in our permits. Thus, the objective for these will be C and I (that is, maintain compliance and reduce emissions).

• Study or Investigate–is appropriate in cases where the CFT thinks improvement will be feasible and beneficial, but study is needed to determine how much improvement can be achieved and timeframes that are feasible. The objective will be to study the alternatives by a target date in preparation for later setting an improvement objective (or dropping the objective if the study reveals that the changes are not financially, technologically, or logistically feasible).

7.3.2 The CFT is also responsible for developing and recommending potential new environmental objectives to top management. In identifying potential new objectives, the CFT considers the following:

• Environmental policy;

• SEAs (especially those that pose chemical risk);

• Applicable laws and regulations and potential future laws and regulations;

• Practical business criteria, such as the potential costs and benefits of pursuing a particular environmental objective and our commitment to pollution prevention; and

• The views of employees and other interested parties.

7.3.3 When developing and recommending objectives, the CFT should consider the number of columns that were marked Yes on Aspects Form. These columns relate to the significance criteria established by this EMS (legal/facility requirements, community concerns, pollution prevention potential, and/or potential impact on the environment). Those SEAs with two or more Yes rankings will likely be good candidates for control, improvement, or investigation.

7.3.4 Performance against objectives and targets shall be reviewed at least every six months by the CFT and reported at the management review meeting (see Environmental Management System Management Review). The management review shall endorse the facility environmental objectives and targets.

7.4 Establishing and Maintaining Environmental Management Programs

7.4.1 The CFT shall establish and maintain environmental management programs for achieving the objectives and targets developed for the significant environmental

aspects identified and updated every six months.

7.4.2 Environmental management programs shall identify the means, time frames and those responsible for achieving associated objectives and targets. Responsibility will be identified at each relevant function and level of the facility.

8.0 General Rules

8.1 The CFT shall include representation from all appropriate functional areas and departments.

8.2 The environmental aspects and significant aspects associated with the operations of semi-permanent on-site contractors are covered by this procedure.

8.3 Interested parties include employees and the community.

8.4 The environmental management programs that address the following areas should be created if applicable objectives and targets are developed:

8.4.1 Compliance Assurance

8.4.2 Pollution Prevention/Waste Minimization

8.4.3 Energy Management

8.4.4 Materials Management

9.0 Frequency

This procedure will be repeated at least annually. More frequent updates will be conducted for new projects or processes that affect the list of the facility's significant aspects.

10.0 Records

The originals of completed Aspects Forms are maintained by the EMR or designee.

Table A.2: Sample Environmental Policy

ENVIRONMENTAL MANAGEMENT SYSTEM POLICY STATEMENT

Electric Boat is committed to the preservation of the environment and compliance with all relevant environmental laws and regulations.

We foster this commitment through the implementation of environmentally sustainable processes, pollution prevention, and a continual improvement focus in the design, construction, delivery and repair of submarines, and other contracted products and services.

ENVIRONMENTAL POLICY

APPLICABILITY

This PS applies to all Company locations and to work performed by Electric Boat personnel at non-company locations.

POLICY

1. Electric Boat recognizes environmental resources management as among the highest of its priorities. Environmental considerations will be integrated into all business decisions. Electric Boat must be proactive in reducing or eliminating the use of hazardous/industrial materials as well as the generation and disposal of hazardous or mixed waste.

2. Electric Boat will establish environmental standards that meet all applicable

Federal, state and local laws and regulations.

3. Electric Boat will regularly review its environmental policy to ensure its suitability as well as to ensure continuous improvement in environmental management systems, practices and procedures.

4. Electric Boat will conduct periodic environmental assessments**,** including annual Corporate Annual Review for Environment package**,** to evaluate performance against Company and legal requirements and provide results to management.

5. Electric Boat will design its products and select its processes in such a way as to reduce or eliminate hazardous/industrial material wherever possible and to minimize or eliminate pollution. Product design and process selection will adhere to proven principles, including material review prior to selection, thorough engineering controls, adequate pre-work planning, minimization of materials used, and segregation of hazardous from non-hazardous materials.

6. Electric Boat is committed to conducting its operations in a manner that safeguards the natural environment and preserves natural resources; therefore, source reduction, material recovery and material recycling, as opposed to disposal will be considered wherever feasible.

7. Electric Boat requires active participation and involvement by all personnel in following established procedures including the proper identification, collection, storage and disposal of hazardous materials. Every employee is encouraged to recommend improved hazardous materials work practices.

8. Electric Boat will educate, train and motivate employees to conduct all activities in an environmentally responsible manner.

9. All levels of leadership and management are responsible for establishing and attaining goals within each organization to effect this policy.

Electric Boat will promote sound environmental practices and principles with suppliers and subcontractors. Electric Boat encourages open communications with surrounding communities, employees, customers and government officials.

Table A.3: Sample Procedure for Monitoring and Measurement

Procedure for Monitoring and Measurement

1.0 Purpose/Scope

This procedure defines the mechanism for the monitoring and measurement of significant environmental aspects associated with [Shipyard's Name] operations and activities, the calibration and maintenance of monitoring equipment, and the evaluation of compliance with relevant environmental legal and policy requirements.

2.0 Activities Affected

All areas and departments

3.0 Forms Used

None

4.0 References

4.1 Procedure for Identification of Legal and Other Requirements

4.2 Procedure for Environmental Aspects, Objectives and Targets, and Programs

4.3 Procedure for Communication with Stakeholders

4.4 Procedure for Environmental Management System Management Review

4.5 Procedure for Emergency Preparedness and Response

4.6 Procedure for Environmental Training and Awareness

4.7 Procedure for Environmental Review for New Purchases, Processes, and Products

4.8 Procedure for Contractors and Sub-contractors

4.9 Procedure for Corrective and Preventive Action

4.10 Procedure for Environmental Management System and Regulatory Compliance Audits

4.11 ISO 14001:1996, Element 4.5.1

5.0 Definitions

None

6.0 Exclusions

None

7.0 Procedure

7.1 Monitoring and Measurement of Significant Aspects, Objectives and Targets, and Operational Controls

7.1.1 The monitoring and measurement of key characteristics and environmental performance associated with significant aspects will be specified in environmental management programs.

7.1.2 The monitoring and measurement of conformance to specified environmental objectives and targets will be accomplished through the internal system audit process and through the creation of Corrective Action Requests.

7.1.3 Operational controls will be monitored and measured as indicated in applicable environmental management programs, procedures, work practices, or visual aids. The methods, frequencies and responsible parties for completing the monitoring and measuring activities will be specified in these documents.

7.2 Calibration and Maintenance of Environmental Monitoring Equipment

7.2.1 Relevant areas and departments shall ensure that environmental monitoring equipment is calibrated and maintained at a frequency consistent with manufacturers' recommendations, or at least every year if those recommendations are unknown. Relevant areas and departments shall maintain calibration and maintenance records as necessary to prove conformance with this procedure.

7.2.2 Calibration and maintenance of environmental monitoring equipment shall be addressed in area and department preventative maintenance programs, where applicable, or in local work practices, if desired.

7.2.3 Each applicable area and department will maintain a list of EMS equipment requiring calibration and the corresponding calibration frequency.

7.3 Evaluation of Compliance

7.3.1 The evaluation of compliance with relevant environmental legal requirements shall be accomplished through the implementation of Procedures for

Environmental Management System and Regulatory Compliance Audits.

8.0 Frequency

Ongoing

9.0 Records

Records shall be retained consistent with the Procedure for Environmental Records.

Table A.4: Sample Procedure for Corrective and Preventive Action

Procedure for Corrective and Preventive Action

1.0 Purpose

The purpose of this procedure is to establish and outline the process for identifying, documenting, analyzing, and implementing preventive and corrective actions. Preventive or corrective actions may be initiated using this procedure for any environmental problem affecting the organization.

2.0 Activities Affected

All areas and departments

3.0 Forms Used

3.1 Corrective and Preventive Action Request

3.2 Corrective and Preventive Action Tracking Log

4.0 References

4.0 Procedure for Environmental Management System and Regulatory Compliance Audits

4.1 Procedure for Emergency Preparedness and Response

4.2 Procedure for Communication with Stakeholders

4.3 Procedure for Document Control

4.4 Procedure for Monitoring and Measurement

4.5 ISO 14001:1996, Element 4.5.2

5.0 Definitions

None

6.0 Exclusions

None

7.0 Procedure

7.1 Where non-conformances or non-compliances are identified through the environmental audit process, the responsible and accountable area or department representative, affected area or department manager, audit team member or Environmental Management Representative (EMR), is responsible for:

7.1.1 Identifying the root cause(s) of non-conformances or non-compliances;

7.1.2 Identifying appropriate corrective and preventive actions (including modifying

or creating environmental procedures and work practices);

7.1.3 Planning and implementing corrective and preventive actions; and

7.1.4 Verifying the close-out and effectiveness of corrective and preventive actions.

7.2 Where non-conformances are identified outside the environmental audit process, the Quality Manager or designee will generate a CAR, as appropriate. The affected area or department manager, or designee, is responsible for:

a) Identifying the root cause(s) of these non-conformances;

b) Identifying appropriate corrective and preventive actions (including modifying or creating environmental procedures and work practices);

c) Planning and implementing corrective and preventive actions; and

d) Verifying the close-out and effectiveness of corrective and preventive actions.

The Quality Manager or designee will verify proper implementation of corrective and preventive actions.

7.3 Where non-compliances are identified outside the environmental audit process, the EMR or designee will generate a CAR, as appropriate.

8.0 Frequency

As needed following reviews

9.0 Records

Records shall be retained consistent with the Procedure for Environmental Records.

Table A.5: Sample Procedure for Environmental Records

Procedure for Environmental Records

1.0 Purpose/Scope This procedure identifies the management of environmental records at the [Shipyard's Name].

2.0 Activities Affected

The areas and departments specified in the Index of Environmental Records.

3.0 Forms Used

3.1 Index of Environmental Records

4.0 References

4.1 ISO 14001:1996, Element 5.5.3

5.0 Definitions

Records: documented information that: (a) is evidence of an environmental activity or event that has been or is being performed; or (b) is required to be retained for future reference. It is information on environmental performance.

6.0 Exclusions

None

7.0 Procedure

7.1 Records shall be maintained and retained as specified in the Index of Environmental Records.

7.2 Record retention will be consistent with applicable legal and other requirements.

7.3 Each area or department manager or designee shall have access to a master list of all EMS records relevant to their area or department, as applicable.

7.4 Each activity responsible for maintaining a record has the responsibility for establishing the method for filing and indexing records to ensure accessibility.

8.0 General Rules

Records shall be legible, readily retrievable, and stored and maintained so as to prevent damage, deterioration, or loss as appropriate to the importance of the record.

9.0 Records

Records shall be retained as specified in this procedure.

Table A.6: Sample Procedure for EMS and Regulatory Compliance Audits

Procedure for EMS and Regulatory Compliance Audits

1.0 Purpose/Scope
This procedure defines the mechanism for the planning and implementation of internal environmental management system and regulatory compliance audits at [Shipyard's Name].

2.0 Activities Affected
All areas and departments

3.0 Forms Used

3.1 Internal EMS Audit Checklist

3.2 Corrective and Preventive Action Request (CAR)

3.3 Corrective and Preventive Action Tracking Log

3.4 Internal EMS Audit Schedule Form

4.0 References

4.1 Procedure for Corrective and Preventive Action

4.2 Procedure for Environmental Management System Management Review

4.3 ISO 14001: 1996, Elements 4.5.1 and 4.5.4

4.4 Compliance Assurance Program Guidelines

5.0 Definitions

5.1 Auditee: individual audited.

5.2 Auditor: audit team member performing the audit.

5.3 Audit Criteria: policies, practices, procedures, or other requirements against which the auditor compares objective evidence about the subject matter.

5.4 Audit Program Leader: individual responsible for maintaining the Environmental Audit Program.

5.5 CAR: corrective and preventive action request that identifies observed non-conformances.

5.6 Finding: an existing condition supported by objective evidence.

5.7 Non-conformance: the non-fulfillment of specified system requirements.

5.8 Objective Evidence: qualitative or quantitative information, records, or statements of fact pertaining to the existence and implementation of an EMS element that is based on measurement or test and which can be verified.

6.0 Exclusions

None

7.0 Procedure

7.1 Conducting the Internal EMS Audit

7.1.1 The Quality Manager, or designee, shall plan, schedule, and implement internal environmental management system audits. The audit schedule, developed on the Internal EMS Audit Schedule Form, will be used to identify the frequency and location of internal environmental management system audits and will be revised as necessary. Revisions to the audit schedule may be based on the results of prior audits.

7.1.2 Audit frequency will be established on a priority basis, taking into account previous audit results and the relative importance of the area or department, and will not be less that once per year for each location. Each area or department will be audited at least once every three years on all system elements.

7.1.3 For each area or department within the facility, an audit team will be formed whose membership has no responsibility within the area or department to be audited. This independence will be documented by indicating on the audit report or other audit record the organization to which the auditors belong.

7.1.4 Competent audit teams shall perform internal environmental audits.

7.1.4.1 At least one member of the team shall be competent in the environmental auditing process through either training and/or experience.

7.1.4.2 All members of the audit team shall have an awareness and understanding of the [Shipyard's Name] environmental management system by virtue of formal and informal training.

7.1.5 Audit scope and criteria will be established for each area or department prior to each audit. Audit criteria may be documented by the audit team on Internal EMS Audit Checklist and the checklist used during the audits.

7.1.6 During the audit, the audit team will record audit information, such as: items checked; individuals interviewed; any concerns identified; and any corrective or preventive actions completed during the audit. The audit team shall promptly notify the Environmental Management Representative (EMR), or designee, of any possible regulatory non-compliance. Upon verification of non-compliance, the EMR shall notify facility management.

7.1.7 Upon completion of the internal audit, the audit team will review their findings with the auditee and responsible and accountable area or department representative. The team will then initiate a CAR for each finding of non-conformance (Note: a non-compliance is a non-conformance) using the Corrective Action Request form.

7.1.8 The Quality Manager or designee will track the status of all outstanding CAR's

using the Corrective and Preventive Action Tracking Log.

7.1.9 The responsible and accountable area or department representative will identify the route cause of the non-conformance (where applicable), corrective and preventive actions to be undertaken, and the dates by which these actions will be completed. This information will be documented on the original CAR and the CAR sent to the applicable area or department manager. A copy of the CAR will also be provided to the Quality Manager, or designee, within the time frame established during the audit review meeting.

7.1.10 Upon completion of the corrective and preventive actions, the area or department manager will acknowledge completion of these actions by signing the original CAR and returning it to the Quality Manager or designee.

7.1.11 Corrective and preventive actions will be verified during the next internal audit or the area or department manager may contact the Quality Manager to schedule verification of actions prior to the next audit.

7.1.12 When full conformance is determined or corrective and preventive actions accepted, the audit team leader will sign the original CAR and return it to the Quality Manager, or designee, for closure and filing.

7.1.13 At least annually, the EMR, or designee, will summarize system audit results with facility management as specified in the Procedure for Environmental Management System Management Review.

7.2 Conducting the Compliance Assessment Audit

7.2.1 The EMR, or designee, is responsible for planning, scheduling, and implementing internal environmental regulatory compliance assessment audits, including the identification of required resources.

7.2.2 The EMR, or designee, develops and maintains the environmental compliance assurance program and issues program support documents, based on facility environmental compliance assurance guidelines, where available.

7.2.3 During a compliance assessment audit, assessment team members will record information, such as: items checked; individuals interviewed; and any possible regulatory non-compliance issues. The assessment team shall promptly notify the EMR, or designee, of any possible regulatory non-compliance. Upon verification of non-compliance, the EMR shall notify facility management.

7.2.4 The assessment team reviews possible regulatory non-compliance issues with the responsible and accountable area or department representative. The team also prepares a CAR identifying the issues, corrective and preventive actions required, and the individuals responsible for completing the actions. The EMR, or designee, and area or department manager will concur with the CAR before its issuance.

7.2.5 Upon completion of the corrective and preventive actions, the area or department manager will acknowledge completion of these actions by signing the original CAR and returning it to the EMR, or designee.

7.2.6 Corrective and preventive actions will be verified in a timely manner by a member of the assessment team. When full compliance is determined or corrective and preventive actions accepted, the assessment team member will sign the original CAR and return it to the EMR or designee for closure and filing.

7.2.7 Each calendar quarter, the EMR or designee will present a summary of open CAR's that are based on regulatory non-compliance to facility management for

review.

8.0 Frequency

At least annually

9.0 Records

Records shall be retained consistent with the Procedure for Environmental Records.

Table A.7: Sample Procedure for EMS Management Review

Procedure for Environmental Management System Management Review

1.0 Purpose/Scope

This procedure defines the process for the periodic review and evaluation of the [Shipyard's Name] environmental management system by top management to ensure its continuing suitability, adequacy, and effectiveness.

2.0 Activities Affected

All areas and departments

3.0 Forms Used

3.1 Management Review Record

4.0 References

4.1 Procedure for Environmental Aspects, Objectives and Targets, and Programs

4.2 Procedure for Environmental Management System and Regulatory Compliance Audits

4.3 Procedure for Corrective and Preventive Action

4.4 Procedure for Identification of Legal and Other Requirements

4.3 Procedure for Monitoring and Measurement

4.5 ISO 14001:1996, Element 4.6

5.0 Definitions

None

6.0 Exclusions

None

7.0 Procedure

7.1 The Facility Manager and top management shall conduct a review of the environmental management system at least once each year.

7.2 Management review meetings shall be scheduled in advance by the Environmental Management Representative (EMR) and an agenda issued to ensure appropriate preparation and attendance.

7.3 The meeting shall review all applicable components of the [Shipyard's Name] EMS. The EMR shall present information for review and concurrence, which may include, but not be limited to:

• Environmental Policy

- Environmental Aspects
- Objectives and Targets and Programs
- Legal and Other Requirements
- Training, Awareness, and Competence
- Operational Control
- Emergency Preparedness and Response
- Monitoring and Measurement
- Non-conformance and Corrective and Preventive Action
- Environmental System and Regulatory Compliance Audits

7.4 The Facility Manager and top management shall review and confirm their approval and the continual suitability, adequacy and effectiveness of the environmental policy, environmental objectives and targets, environmental management programs, and other elements of the system as well as confirm that regulatory compliance requirements are met.

7.5 The EMR, or designee, will publish and maintain meeting minutes identifying issues discussed and corrective and preventive actions to be taken. Required actions will be assigned to the responsibility of process, area, and functional management.

7.6 Timely decisions will be made.

8.0 General Rules

None

9.0 Records

Records shall be retained consistent with the Procedure for Environmental Records.

Table A.8: Sample Procedure for Identification of Legal and Other Requirements

Procedure for Identification of Legal and Other Requirements

1.0 Purpose

[Shipyard's Name] is committed to complying with all relevant environmental regulations. It also will strive to meet other commitments made in its environmental policy, such as commitments to community involvement, pollution prevention, and continuous improvement. This procedure describes how [Shipyard's Name] identifies relevant legal and other requirements.

2.0 Activities Affected

EMS Coordinator

3.0 Forms Used

Legal and Other Requirements

4.0 References

4.1 Governmental/commercially-available publications

4.2 Other requirements to which [Shipyard's Name] subscribes

4.3 ISO 14001:1996, Element 4.3.2.

5.0 Definitions

None

6.0 Exclusions

None

7.0 Procedure

7.1 The Environmental Management Representative (EMR) is responsible for tracking relevant environmental laws and regulations and evaluating their potential impact on the facility's operations. He or she employs several techniques to track, identify, and evaluate applicable laws and regulations. These techniques include commercial databases, information from the trade association, direct communication with national and state regulatory agencies, and periodic refresher training on environmental laws.

7.2 As necessary, the EMR may call upon off-site resources such as consultants or attorneys.

7.3 The EMR compiles and maintains updated copies of applicable environmental laws and regulations.

7.4 The EMR, working with the EMS Coordinator and Cross Functional Team (CFT), correlates these regulations to the business activities and the related environmental aspects.

8.0 Frequency

Ongoing

9.0 Records

Form for Legal and Other Requirements is maintained by the EMS Coordinator. The EMR maintains copies of the applicable regulations.

Appendix-B – Main Processes of Shipbuilding and Ship Repair

In this section, main processes of shipbuilding and repair are described with decision making flow diagrams. After each process flow chart, aspect identifications of the mentioned processes are described. With the given inputs, processes, outputs and products, annual quantities and impact types are determined.

After the aspects, significance determination of each flow chart is assessed. Impact factor levels for legislation, risk (severity and probability) and operational control are given. Grand total is calculated by the addition of each item, while risk is calculated as the multiplication of severity and probability. These grand totals are assessed for being as lower than 10; between 10 and 20; or above 20. Each interval is named to be non-significant, significant and immediate response. These aspects are evaluated as Significant Environmental Aspects (SEA) to mitigate by Environmental Management Program. While non-significant items are not included in the program, significant aspects are assessed in details. Immediate response items are promptly handled and the possible threat is remedied as soon as possible.

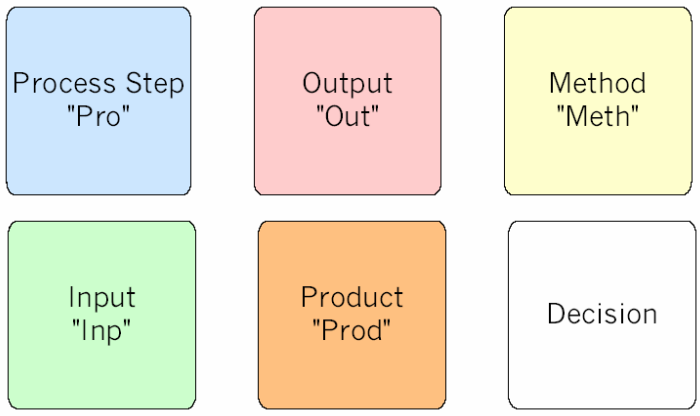

Figure B.1: Color and abbreviation key for the process diagrams

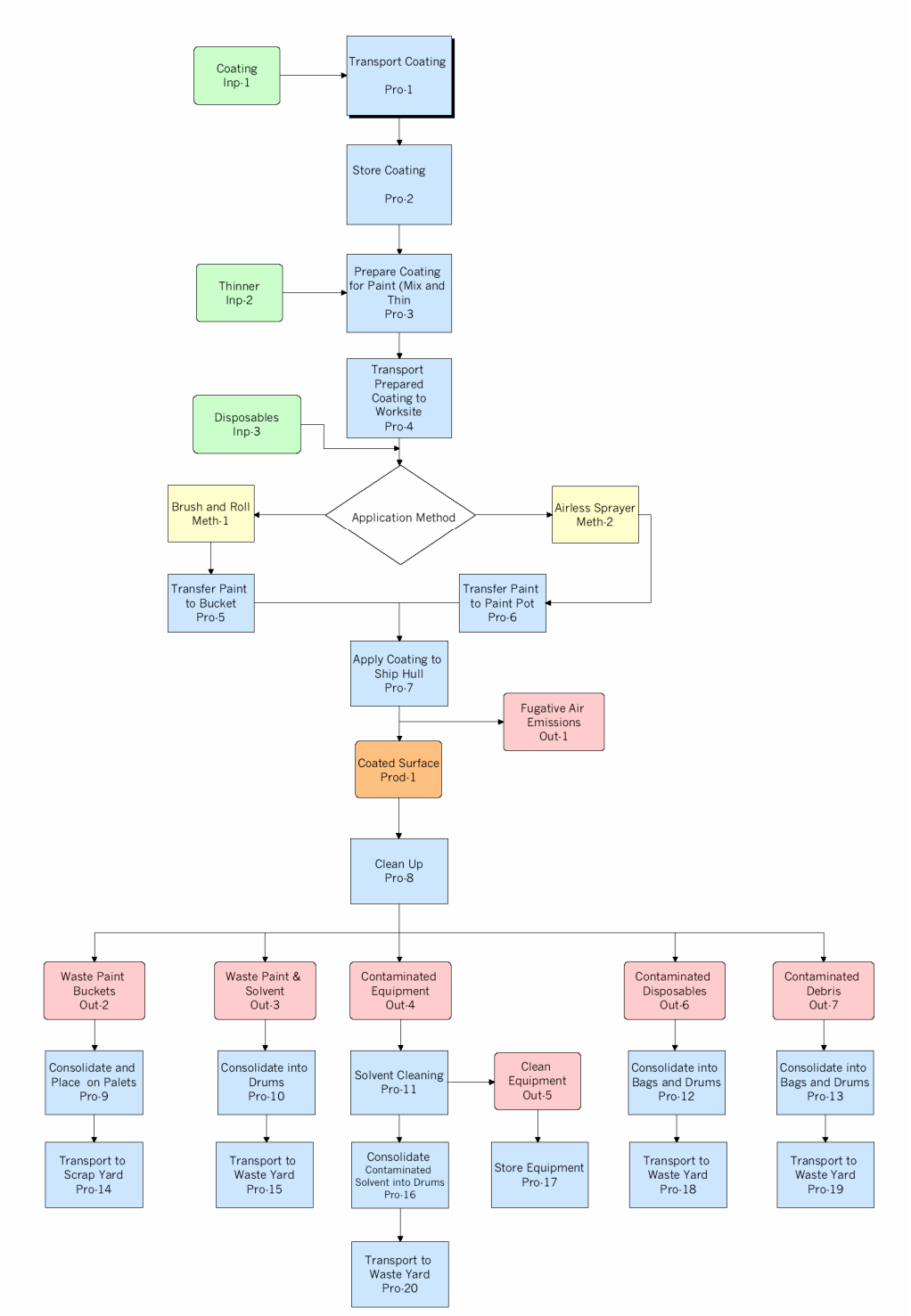

Figure B.2: Flow Diagram for painting

Table B.1: Aspect identification for painting

Category/Aspect	Inputs, Processes, Outputs, Products	Quantity or Volume (per year)	Type of Impact					
			Emissions to Air	Discharges to Water	Waste Management (hazardous / special substances	Contamination of Land	Use of raw materials/ depleting non-renewable resources	Local envt/ community issues
Energy Usage:								
Electricity / Paint Mixers	Mix and thin coatings (Pro-3)	10 kw	x				x	
Diesel Fuel / Forklift	Transport coatings and waste to dry dock (Pro-1, Pro-14, Pro-15, Pro-16, Pro-18, Pro-19, Pro-20)	10 tons	x				x	
Supplies/Disposables:								
Rags	Inp-3	500 kg			x		x	
Gloves	lnp-3	100 kg			x		x	
Sand Paper	Inp-3	50 kg			x		x	
Air Emissions:								
Fugitive VOCs	Applying Coating (Pro-7)		x					x
Over Spray, Fugitive Particulate Emissions	Applying Coating (Pro-7)		x			x		
Noise/Odor/Radiation:								
Odor from VOCs Fume	Applying Coating (Pro-7)		x					x
Wastes:								
Contaminated Scrap	Waste Paint Cans (Out-1)	2,000 kg			x			
Contaminated Waste	Suites, Rollers, Brushes, Filter Masks, Paint Stirrers, Drop Clothes, Masking Tape (Out-5), Debris (Out-6)				x			
Waste Chemicals	Waste Paint and Solvent (Out-2)	2,500 l			x			x
Solid Waste, Landfill	Consolidate contaminate disposables (Pro-12) and debris (Pro-13)	150 tons				x		x
Spillage and Other:								
Spillage	Transport waste cans, cleaning solvents, contaminated solvents and debris to scrap yard (Pro-7, Pro-18, Pro-19, Pro-20)	100 l		x	x	x		
	Consolidate equipment cleaning solvent into drums (Pro-10)	300 l			x			
	Transport coatings and thinners (Pro-1 through Pro-6)	20 l				x		
Spillage, Contaminated Scrap	Consolidate Waste (Pro-9)	20 l			x	x		
Coating Thinner Spillage	Consolidate waste paint and solvent (Pro-10,	300 l			x	x		
	Solvent Cleaning of (Pro-11)	200 l			x	x		
	Consolidate Contaminated Solvent into Drums (Pro-7)	250 l			x	x		

Table B.2: Significance determination for painting

Category/Aspect	Impact Factors Levels														Grand Total (Legislation + Operational Control + 3rd Party Interest + (probability*severity)	Significant Environmental Aspect (SEA) mitigate by Program (Significant,(S), non-significant(NS), immediate response(IR))
	Legislation				Risk						Operational Control					
					Probability			Severity								
	None	Industry Standard	Legislation Expected	Legislation Enforced	Low Occurrence	Medium Occurrence	High Occurrence	Low Impact	Medium Impact	High Impact	Fully Controlled	Medium Control	Minor Control	No Control		
	0	1	2	3	1	2	3	2	4	6	0	1	2	3		
Energy Usage:																
Electricity / Paint Mixers	0						3	2			0				6	NS
Diesel Fuel / Forklift	0						3	2			0				6	NS
Supplies/Disposables:																
Rags	0					2		2				1			5	NS
Gloves	0					2		2				1			5	NS
Sand Paper	0					2		2				1			5	NS
Air Emissions:																
Fugitive VOCs			2			2			4				2		12	S
Over Spray, Fugitive Particulate Emissions		1				2			4				2		11	S
Noise/Odor/Radiation:																
Odor from VOCs Fume	0				1			2					2		4	NS
Wastes:																
Contaminated Scrap				3		2			4			1			12	S
Contaminated Waste	0					2		2				1			5	NS
Waste Chemicals				3		2			4			1			12	NS
Solid Waste, Landfill				3		2		2				1			8	NS
Spillage and Other:																
Spillage	0				1				4			1			5	NS
	0				1				4			1			5	NS
	0				1				4			1			5	NS
Spillage, Contaminated Scrap	0				1				4			1			5	NS
Coating Thinner Spillage	0				1				4			1			5	NS
	0				1				4			1			5	NS
	0				1				4			1			5	NS

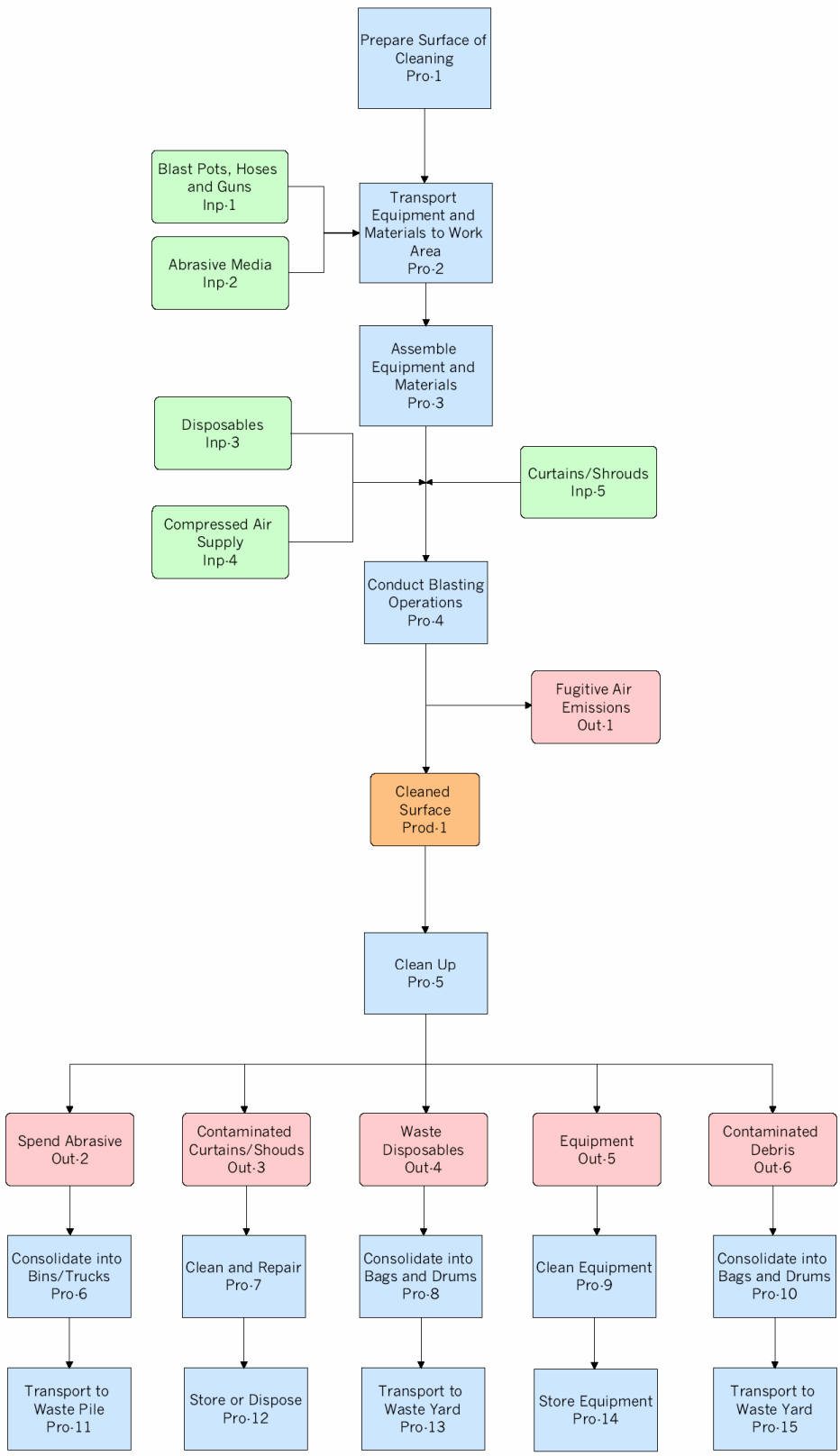

Figure B.3: Flow diagram for dry abrasive blasting

Table B.3: Aspect identification for dry abrasive blasting

Category/Aspect	Inputs, Processes, Outputs, Products	Quantity or Volume (per year)	Type of Impact					
			Emissions to Air	Discharges to Water	Waste Management (hazardous / special substances	Contamination of Land	Use of raw materials/ depleting non-renewable resources	Local envt/ community issues
Energy Usage:								
Electricity	Compress Air Supply (Inp-4)	10.000 kw					x	
Diesel Fuel/Forklift	Transport Equipment, Materials, Scrap and Waste to and from Work Area (Pro-2), (Pro-11), (pro-12), (Pro-13), (Pro-14) and (Pro-15)	4.000 l	x				x	
Supplies/Disposables:								
Rags	Inp-3	500 kg			x		x	
Gloves	Inp-3	100 kg			x		x	
Air Emissions:								
Fugitive Particulates	Fugitive Air Emissions(Out-1)		x					x
Noise/Odor/Radiation:								
Blasting Operations	Conduct Blasting Operations (Pro-4)	98 decibels	x					x
Wastes:								
Waste Abrasive	Spent Abrasive (Out-2)	7.500 tons	x	x	x		x	

Table B.4: Significance determination for dry abrasive blasting

Category/Aspect	Impact Factors Levels														Grand Total (Legislation + Operational Control + 3rd Party Interest + (probability*severity)	Significant Environmental Aspect (SEA) mitigate by Program (Significant,(S), non-significant(NS), immediate response(IR))
	Legislation				Risk						Operational Control					
					Probability			Severity								
	None	Industry Standard	Legislation Expected	Legislation Enforced	Low Occurrence	Medium Occurrence	High Occurrence	Low Impact	Medium Impact	High Impact	Fully Controlled	Medium Control	Minor Control	No Control		
	0	1	2	3	1	2	3	2	4	6	0	1	2	3		
Energy Usage:																
Electricity	0						3	2			0				6	NS
Diesel Fuel/Forklift	0						3	2			0				6	NS
Supplies/Disposables:																
Rags	0					2		2				1			5	NS
Gloves	0					2		2				1			5	NS
Air Emissions:																
Fugitive Particulates				3		2		2					2		9	NS
Noise/Odor/Radiation:																
Blasting Operations		1					3		4				2		15	S
Wastes:																
Waste Abrasive				3			3			6		1			22	IR

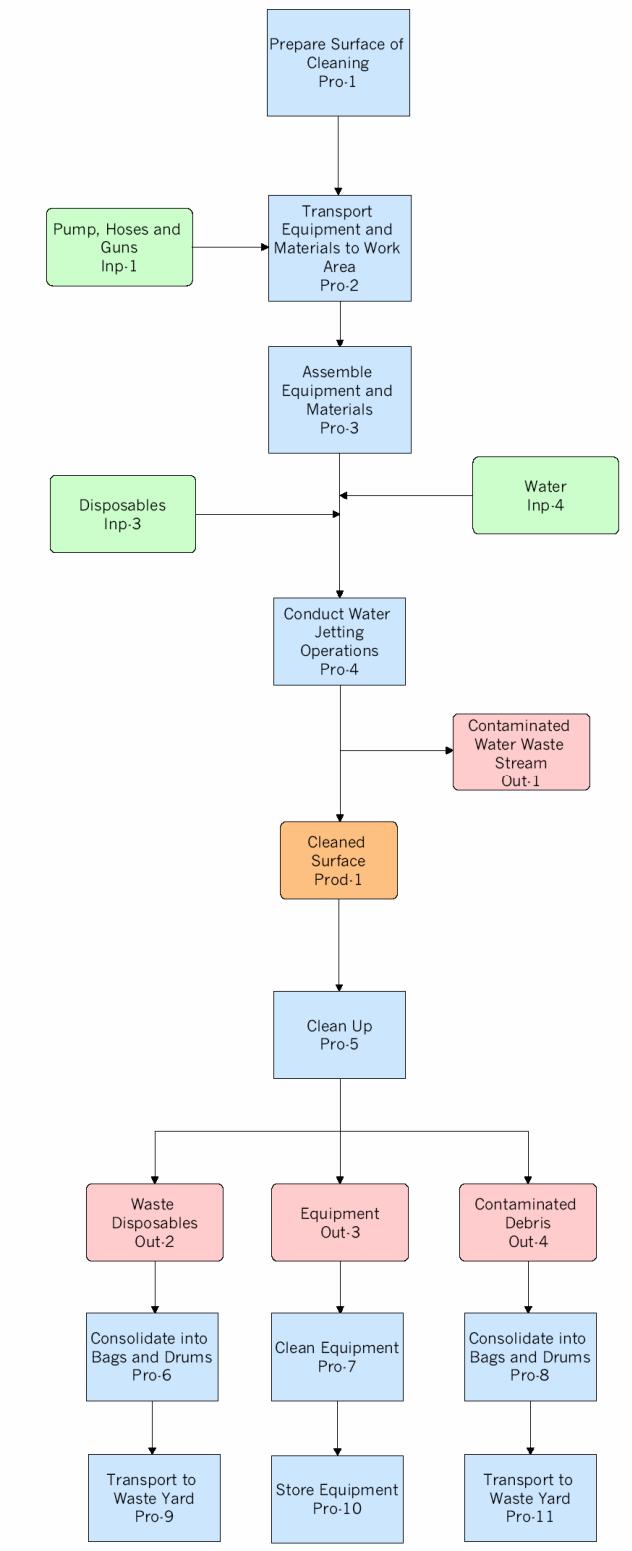

Figure B.4: Flow diagram for ultra high pressure water jetting

Table B.5: Aspect identification for ultra high pressure water jetting

Category/Aspect	Inputs, Processes, Outputs, Products	Quantity or Volume (per year)	Type of Impact					
			Emissions to Air	Discharges to Water	Waste Management (hazardous / special substances	Contamination of Land	Use of raw materials/ depleting non-renewable resources	Local envt/ community issues
Energy Usage:								
Diesel Fuel/Pumps	Conduct Water jetting Operations (pro-4)	15 tons	x				x	
Water Usage:								
Water	Water (Inp-4)	2.500 tons					x	
Supplies/Disposables:								
Rags	Inp-3	500 kg			x		x	
Gloves	Inp-3	100 kg			x		x	
Noise/Odor/Radiation:								
Water Jetting Operations	Conduct Water jetting Operations (Pro-4)	98 decibels						x
Wastes:								
Solid Waste	Waste Disposables and Debris (Out-2), (Out-4)	5 tons			x			
Water Discharges:								
Contaminated Wastewater	Contaminated Waste Water Stream (Out-1)	2.000 tons		x				x

Table B.6: Significance determination for ultra high pressure water jetting

Category/Aspect	Impact Factors Levels														Grand Total (Legislation + Operational Control + 3rd Party Interest + (probability*severity))	Significant Environmental Aspect (SEA) mitigate by Program (Significant,(S), non-significant(NS), immediate response(IR))
	Legislation				Risk						Operational Control					
					Probability			Severity								
	None	Industry Standard	Legislation Expected	Legislation Enforced	Low Occurrence	Medium Occurrence	High Occurrence	Low Impact	Medium Impact	High Impact	Fully Controlled	Medium Control	Minor Control	No Control		
	0	1	2	3	1	2	3	2	4	6	0	1	2	3		
Energy Usage:																
Diesel Fuel/Pumps	0						3	2			0				6	NS
Water Usage:																
Water	0					2		2			0				4	NS
Supplies/Disposables:																
Rags	0					2		2				1			5	NS
Gloves	0					2		2				1			5	NS
Noise/Odor/Radiation:																
Water Jetting Operations		1				2			4		0				9	NS
Wastes:																
Solid Waste				3		2		2				1			8	NS
Water Discharges:																
Contaminated Wastewater				3	1				4				2		9	NS

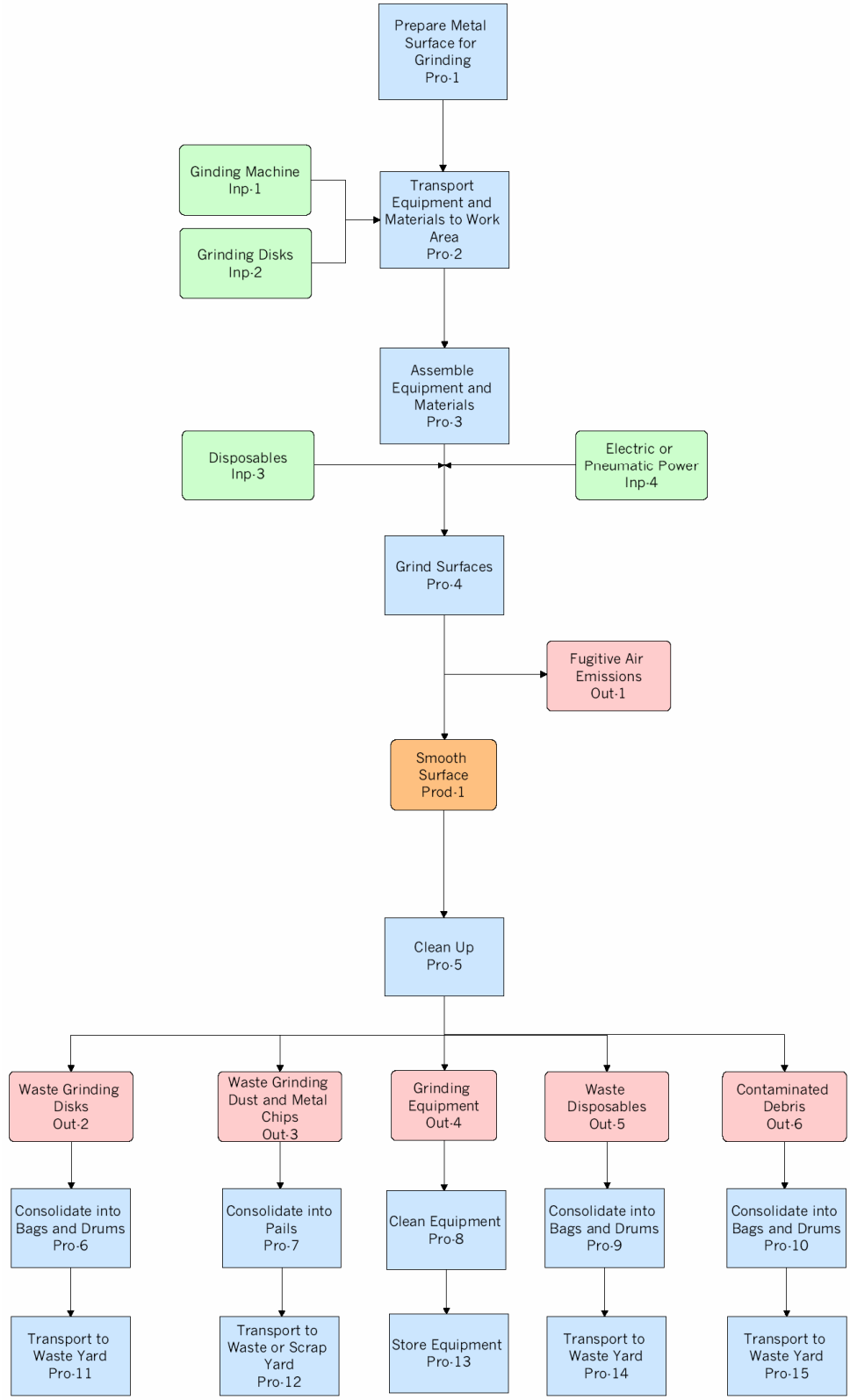

Figure B.5: Flow diagram for metal grinding

Table B.7: Aspect identification for metal grinding

Category/Aspect	Inputs, Processes, Outputs, Products	Quantity or Volume (per year)	Type of Impact					
			Emissions to Air	Discharges to Water	Waste Management (hazardous / special substances	Contamination of Land	Use of raw materials/ depleting non-renewable resources	Local envt/ community issues
Energy Usage:								
Electricity	Electric or Pneumatic Power (Inp-4)	5.000 kw	x				x	
Diesel Fuel/Forklift	Transport Equipment, Materials, Scrap and Waste to and from work Area (Pro-2), (Pro-11), (Pro-12), (Pro-l4) and (Pro-15)	4 tons	x				x	
Supplies/Disposables:								
Grinding Discs	Inp-2	300 kg			x			
Gloves	Inp-3	100 kg			x		x	
Air Emissions:								
Metal Dust and Fumes	Fugitive Air Emissions (Out-1)	2 tons	x					x
Wastes:								
Solid Waste	Waste Grinding disks Metal dust and chips, disposables and debris (Out-2), (Out-3), (Out-5), (Out-6)	4 tons			x	x		
Water Discharges								
Heavy Metal Contaminated Water	Fugitive Air Emissions (Out-1)			x				x
Spillage and Other:								
Spillage	Transport Equipment, Materials, Scrap and Waste to and from Work Area (Pro-2), (Pro-11), (Pro-72), (Pro-14) and (Pro-15)	50 kg		x	x	x		

Table B.8: Significance determination for metal grinding

Category/Aspect	Impact Factors Levels														Grand Total (Legislation + Operational Control + 3rd Party Interest + (probability*severity)	Significant Environmental Aspect (SEA) mitigate by Program (Significant,(S), non-significant(NS), immediate response(IR))
	Legislation				Risk						Operational Control					
					Probability			Severity								
	None	Industry Standard	Legislation Expected	Legislation Enforced	Low Occurrence	Medium Occurrence	High Occurrence	Low Impact	Medium Impact	High Impact	Fully Controlled	Medium Control	Minor Control	No Control		
	0	1	2	3	1	2	3	2	4	6	0	1	2	3		
Energy Usage:																
Elecricity	0						3	2			0				6	NS
Diesel Fuel/Forklift	0						3	2			0				6	NS
Supplies/Disposables:																
Grinding Discs		1			1			2				1			4	NS
Gloves	0					2		2				1			5	NS
Air Emissions:																
Metal Dust and Fumes				3		2		2					2		9	NS
Wastes:																
Solid Waste				3		2		2				1			8	NS
Water Discharges																
Heavy Metal Contaminated Water				3	1					6				3	12	S
Spillage and Other:																
Spillage	0					2		2					2		6	NS

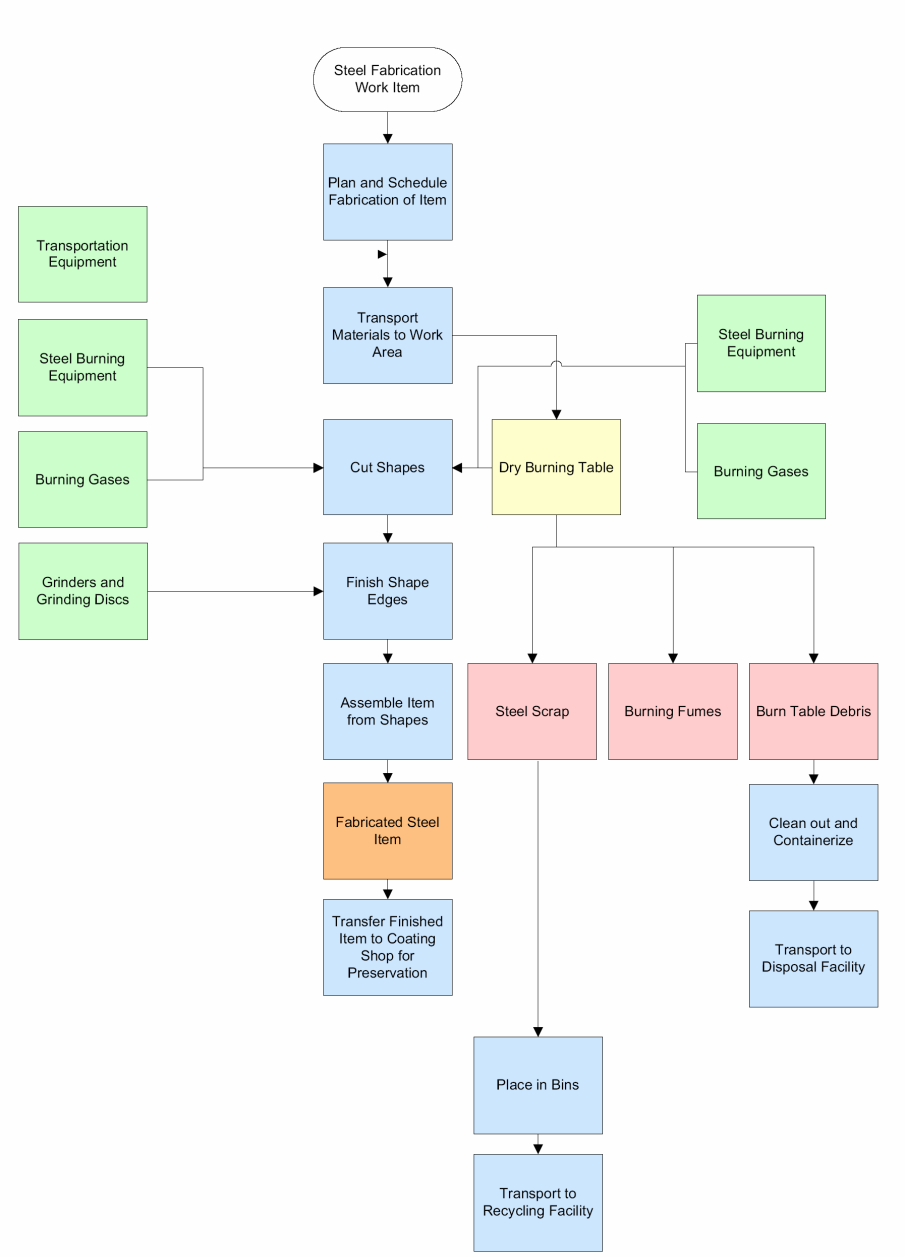

Figure B.6: Flow diagram for steel fabrication

Table B.9: Aspect identification for steel fabrication

Category/Aspect	Inputs, Processes, Outputs, Products	Quantity or Volume (per year)	Type of Impact					
			Emissions to Air	Discharges to Water	Waste Management (hazardous / special substances	Contamination of Land	Use of raw materials/ depleting non-renewable resources	Local envt/ community issues
Energy Usage:								
Diesel Fuel/Forklifts	Transport raw steel, fabricated items and scrap (Pro 2), (Pro-13), (Pro-8), (Pro-9)	4 tons	x				x	
Supplies/Disposables:								
Burning Gases	Cutting Shapes (Pro-3)		x					x
Grinding Discs	Finish Shapes (Pro-3)	4.500 discs			x			
Welding Rod & Wire	Weld shapes into items (Pro-5)	4 tons			x		x	
Welding Gases	Weld shapes into items (Pro-5)		x					x
Rags	Disposables (Pro-3)	500 kg			x		x	
Gloves	Disposables (Pro-3)	100 kg			x		x	
Air Emissions:								
Burning Fumes	Fugitive Air Emissions (Out-4)		x					x
Noise/Odor/Radiation:								
Burning Noise	Cutting Shapes (Pro-3)	96 decibels						x
Wastes:								
Burn Table Sludge	Table Sludge (Out-2)	6 tons			x	x		
Scrap Steel	Steel Scrap (Out-3)	120 tons			x			

Table B.10: Significance determination for steel fabrication

Category/Aspect	Impact Factors Levels														Grand Total (Legislation + Operational Control + 3rd Party Interest + (probability*severity)	Significant Environmental Aspect (SEA) mitigate by Program (Significant,(S), non-significant(NS), immediate response(IR))
	Legislation				Risk						Operational Control					
					Probability			Severity								
	None	Industry Standard	Legislation Expected	Legislation Enforced	Low Occurrence	Medium Occurrence	High Occurrence	Low Impact	Medium Impact	High Impact	Fully Controlled	Medium Control	Minor Control	No Control		
	0	1	2	3	1	2	3	2	4	6	0	1	2	3		
Energy Usage:																
Diesel Fuel/Forklifts	0						3	2			0				6	NS
Supplies/Disposables:																
Burning Gases		1					3		4			1			14	S
Grinding Discs		1					3	2			0				7	NS
Welding Rod & Wire		1					3	2			0				7	NS
Welding Gases		1					3		4			1			14	S
Rags	0					2		2				1			5	NS
Gloves	0					2		2				1			5	NS
Air Emissions:																
Burning Fumes		1					3		4			1			14	S
Noise/Odor/Radiation:																
Burning Noise		1				2		2				1			6	NS
Wastes:																
Burn Table Sludge	0						3	2			0				6	NS
Scrap Steel	0						3	2			0				6	NS

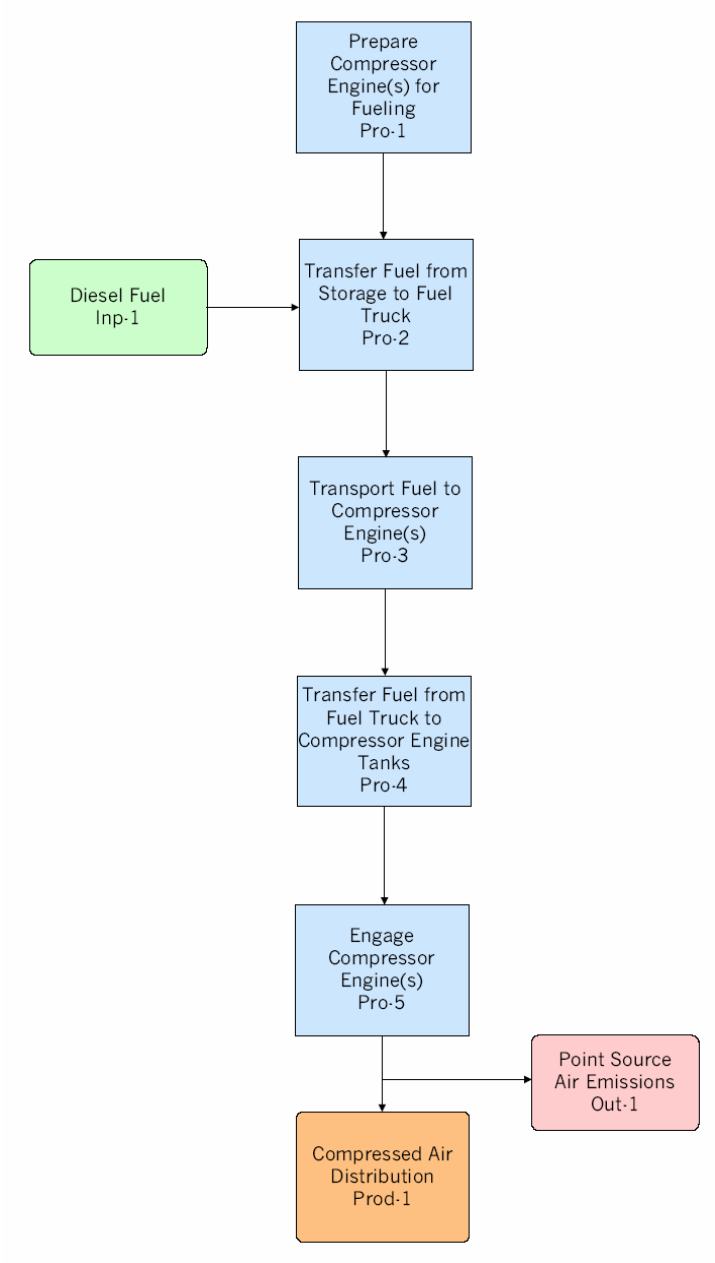

Figure B.7: Flow diagram for compressed air

Table B.11: Aspect identification for compressed air

Category/Aspect	Inputs, Processes, Outputs, Products	Quantity or Volume (per year)	Type of Impact					
			Emissions to Air	Discharges to Water	Waste Management (hazardous / special substances	Contamination of Land	Use of raw materials/ depleting non-renewable resources	Local envt/ community issues
Energy Usage:								
Diesel Fuel	Diesel Fuel	300 tons	x				x	
Air Emissions:								
Combustion Internal Combustion	Operate Compressor Engine (Pro-5)	NO_X / SO_X	x					x
Water Discharges:								
Air Line Condensate	Condensate Traps (Out-2)	300 l		x				x
Spillage and Other:								
Oil Spills	Fuel Transfers (Pro-2), (Pro-4)	300 l				x	x	

Table B.12: Significance determination for compressed air

Category/Aspect	Impact Factors Levels													Grand Total (Legislation + Operational Control + 3rd Party Interest + (probability*severity)	Significant Environmental Aspect (SEA) mitigate by Program (Significant,(S), non-significant(NS), immediate response(IR))
	Legislation				Risk						Operational Control				
					Probability			Severity							
	None	Industry Standard	Legislation Expected	Legislation Enforced	Low Occurrence	Medium Occurrence	High Occurrence	Low Impact	Medium Impact	High Impact	Fully Controlled	Medium Control	Minor Control	No Control	
	0	1	2	3	1	2	3	2	4	6	0	1	2	3	
Energy Usage:															
Diesel Fuel	0						3	2			0				6	NS
Air Emissions:															
Combustion Internal Combustion				3			3	2			0				9	NS
Water Discharges:															
Air Line Condensate	0				1			2					2		4	NS
Spillage and Other:															
Oil Spills	0				1				4			1			5	NS

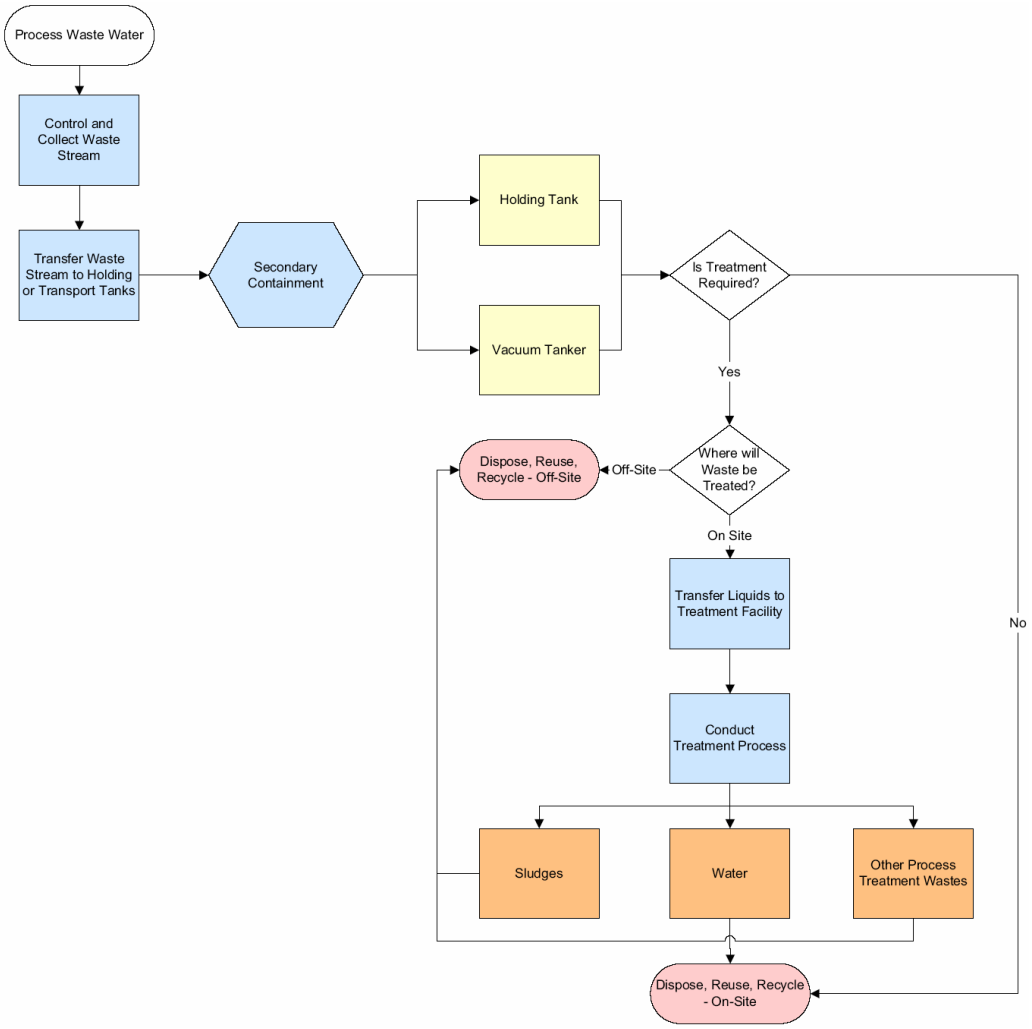

Figure B.8: Flow diagram for wastewater treatment & discharge

Table B.13: Aspect identification for wastewater treatment & discharge

Category/Aspect	Inputs, Processes, Outputs, Products	Quantity or Volume (per year)	Type of Impact					
			Emissions to Air	Discharges to Water	Waste Management (hazardous / special substances	Contamination of Land	Use of raw materials/ depleting non-renewable resources	Local envt/ community issues
Energy Usage:								
Diesel Fuel	Transfer pumps (Pro-3), (Pro-4)	3 tons	x				x	
Electricity	Transfer pumps (Pro-3), (Pro-4)	1.000 kW	x				x	
Supplies / Disposables:								
Rags	Disposables (Pro-3)	200 kg			x		x	
Gloves	Disposables (Pro-3)	250 pairs			x		x	
Wastes:								
Sludges	Treatment sludges (prod-1)	20 tons			x			
Waste Water	Waste Water derived from Treatment (Prod-2)	1.000 tons		x				x
Spillage and Other:								
Waste water / oily water	Spillage during transfers (Pro-2), (Pro-4)	300 l		x		x		x

Table B.14: Significance determination for wastewater treatment & discharge

Category/Aspect	Impact Factors Levels														Grand Total (Legislation + Operational Control + 3rd Party Interest + (probability*severity)	Significant Environmental Aspect (SEA) mitigate by Program (Significant,(S), non-significant(NS), immediate response(IR))
	Legislation				Risk						Operational Control					
					Probability			Severity								
	None	Industry Standard	Legislation Expected	Legislation Enforced	Low Occurrence	Medium Occurrence	High Occurrence	Low Impact	Medium Impact	High Impact	Fully Controlled	Medium Control	Minor Control	No Control		
	0	1	2	3	1	2	3	2	4	6	0	1	2	3		
Energy Usage:																
Diesel Fuel	0						3	2			0				6	NS
Electricity	0						3	2			0				6	NS
Supplies / Disposables:																
Rags	0					2		2				1			5	NS
Gloves	0					2		2				1			5	NS
Wastes:																
Sludges				3		2		2			0				7	NS
Waste Water				3		2			4		0				11	S
Spillage and Other:																
Waste water / oily water				3		2			4		0				11	S

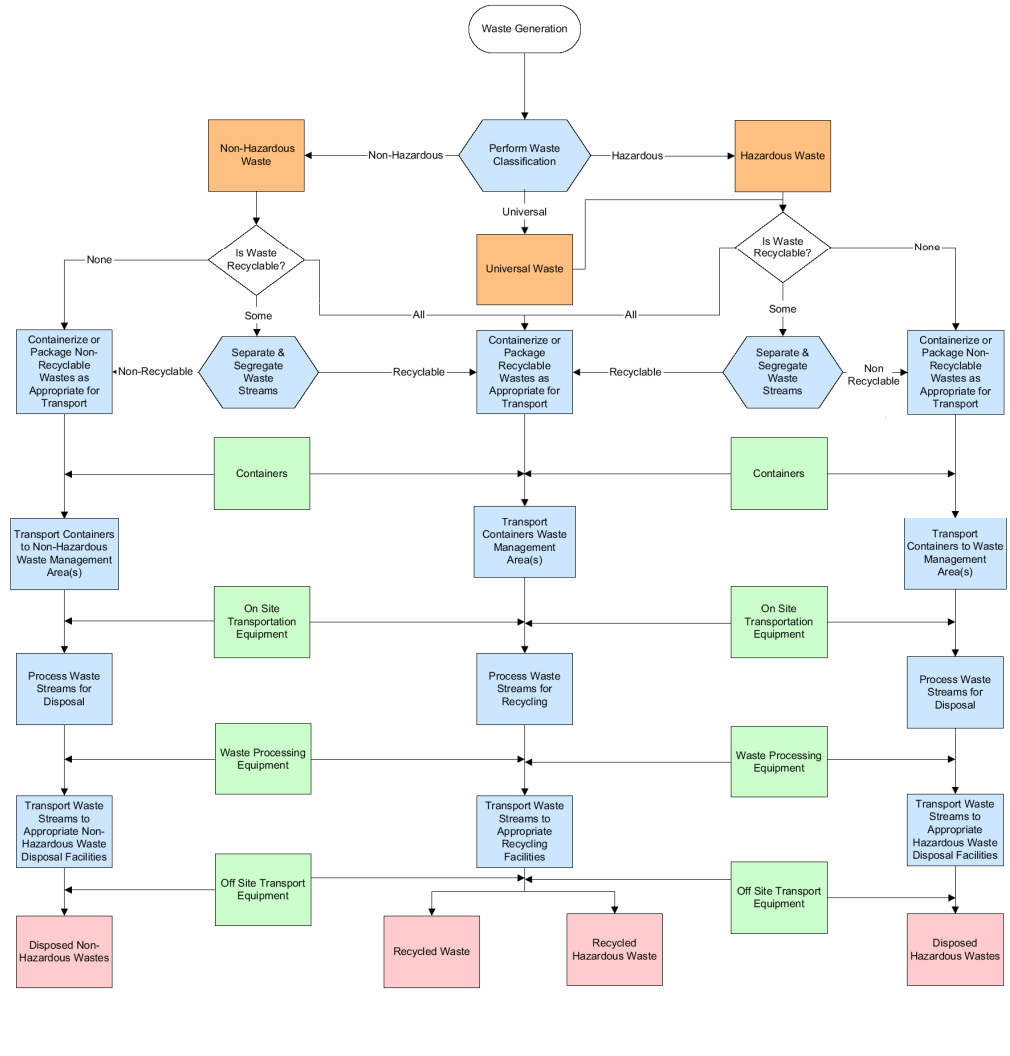

Figure B.9: Flow diagram for waste management

Table B.15: Aspect identification for waste management

Category/Aspect	Inputs, Processes, Outputs, Products	Quantity or Volume (per year)	Type of Impact					
			Emissions to Air	Discharges to Water	Waste Management (hazardous / special substances	Contamination of Land	Use of raw materials/ depleting non-renewable resources	Local envt/ community issues
Energy Usage:								
Diesel Puel/Forklifts	Material movement (Pro-7), (Pro-8), (Pro-9), (Pro-l3),(Pro-14),(Pro-15)	80 tons	x				x	
Supplies / Disposables:								
Containers	Drums, etc. (Inp-4)	300 drums			x			
Wastes:								
Solid Waste Disposal	(Out-1) Non-Hazardous Waste	2.000 tons			x			
Rccycled Non-hazardous Waste	Non-Hazardous Waste (Out-2)	10 tons			x			
Recycled Hazardous Waste	Hazardous Waste (Out-3)	20 tons			x			
Hazardous Waste	Hazardous Waste (Out-4)	7.500 tons			x		x	x
Water Discharges:								
Contaminated Runoff	Exposure of waste areas to rainfall (Pro-4), (Pro-10), (Pro-12)	10 tons	x					x
Spillage and Other:								
Waste Spillage	Spills during transport (Pro-7), (Pro-13), (Pro-9), (Pro-14), (Pro-9), (Pro-15)	750 l	x			x		x

Table B.16: Significance determination for waste management

Category/Aspect	Impact Factors Levels														Grand Total (Legislation + Operational Control + 3rd Party Interest + (probability*severity)	Significant Environmental Aspect (SEA) mitigate by Program (Significant,(S), non-significant(NS), immediate response(IR))
	Legislation				Risk						Operational Control					
					Probability			Severity								
	None	Industry Standard	Legislation Expected	Legislation Enforced	Low Occurrence	Medium Occurrence	High Occurrence	Low Impact	Medium Impact	High Impact	Fully Controlled	Medium Control	Minor Control	No Control		
	0	1	2	3	1	2	3	2	4	6	0	1	2	3		
Energy Usage:																
Diesel Puel/Forklifts	0						3	2			0				6	NS
Supplies/Disposables:																
Containers	0					2		2			0				4	NS
Wastes:																
Solid waste disposal		1					3	2			0				7	NS
Rccycled non-hazardous waste		1					3	2			0				7	NS
Recycled hazardous waste				3		2		2				1			8	NS
Hazardous waste				3	1					6			2		11	S
Water Discharges:																
Contaminated Runoff			2		1				4				2		8	NS
Spillage and Other:																
Waste Spillage	0				1				4			1			5	NS

Appendix-C – Gap Analysis Tool / Self-Assessment Checklist

Table C.1: Gap Analysis Tool/Self-Assessment Checklist

Environmental Management System (EMS) Requirement	Yes	No	NA	Findings / Remarks	Closed (Complete)
Structure and Responsibility					
Facility has defined the roles, responsibilities, and authorities to facilitate an effective EMS.					
Facility management has appointed an Environmental Management Representative (EMR) with defined roles and responsibilities to implement the EMS.					
Facility EMR reports on the performance of the EMS to top management for review and continuous improvement.					
Environmental Policy					
Top management has defined the facility's environmental policy.					
Policy is specific to facility and is appropriate to the nature, scale, and environmental impacts of its activities, products, or services.					
Policy includes a commitment to continuous improvement in environmental performance and the prevention of pollution.					
Policy includes a commitment to sharing information on EMS performance with the community.					
Policy includes a commitment to comply with relevant environmental legislation and regulations.					
Policy includes a commitment to meeting other requirements to which the facility subscribes.					
Policy provides the framework for setting and reviewing environmental objectives and targets.					
Policy is implemented and maintained.					
Policy is communicated to all employees.					
Policy is made available to the public.					
Legal and Other Requirements					
Facility has a procedure to identify and have access to legal and other requirements.					
Facility maintains access to all current Federal, State, and local regulations and ordinances (e.g., by contacting the appropriate authorities or subscribing to a regulatory update service).					
Environmental Aspects					
Facility has established and maintains a procedure to identify the environmental aspects that it can control or over which it can be expected to have an influence in order to determine those that have or can have significant impacts.					

In its significant environmental aspect (SEA) determination facility has considered the aspects associated with on-site contractor activities.					
SEAs form the basis for establishing process and management controls, environmental improvement programs, and SEAs for further investigation and study.					
Objectives and Targets					
Facility has considered technological options, and financial, operational, and business requirements in establishing its objectives and targets.					
Facility has considering legal and other requirements in establishing objectives and targets.					
Facility has considered the views of interested parties in establishing objectives and targets.					
Facility objectives and targets are consistent with environmental policy and its commitment to prevention of pollution.					
Module 7: Environmental Management Programs					
Facility has established and maintained EMPs that include the means and time-frame for achieving its objectives and targets.					
New activities, products, or services are reviewed for potential EMPs, plans, and controls.					
Facility has defined roles and responsibilities for environmental review of new projects.					
Project originator reviews and characterizes the environmental and energy aspects of a new project.					
Module 8: Training, Awareness, and Competence					
The facility has performed a comprehensive environmental training needs analysis.					
Personnel whose work may create a significant impact or is associated with an SEA have received appropriate training.					
Facility has a procedure to make its employees aware of the importance of conformance with policy and procedures, the significant impacts associated with their work, and their roles and responsibilities as these pertain to the environmental policy.					
Facility has a procedure to make its employees aware of: requirements of the EMS, the possible consequences of departure from operating procedures, and emergency preparedness and response.					
Facility personnel performing tasks that can cause significant environmental impact are competent on the basis of education, training, and/or experience.					
Module 9: Communication					

Facility has a procedure for internal communication among the various levels and functions of the facility.					
Internal communications procedures are used to facilitate implementation of regulatory, facility policy, and other requirements.					
Facility has a procedure to log external communications and record the responses to external communications that concern environmental issues.					
EMR or designee responds to inquiries from the community and regulatory agencies.					
A designated person (for example, an Employee Relations Manager or Corporate Communications Officer), in consultation with the EMR, is responsible for responding to media communications.					
Where the external communication relates to an environmental incident, appropriate emergency response procedures are identified (see Module 13) and followed. The facility has considered processes for informal communication of its SEAs and recorded its decision.					
Module 10: EMS Documentation					
Facility has information in paper or electronic form to describe the core elements of the EMS and their interactions.					
Facility has information in paper or electronic form to provide direction to related documentation.					
Module 11: Document Control					
Facility has a procedure for controlling all documents required by the EMS.					
Authorized personnel review documents and forms for adequacy before use or release.					
The EMR or designee maintains a master list of documents and records.					
Relevant documents are available at the locations where they are needed.					
Obsolete documents are promptly removed from all points of use or otherwise assured against unintended use.					
Obsolete documents retained for legal or preservation purposes are properly identified.					
Facility has a procedure for defining responsibility concerning the creation and modification of documents.					
Documentation is legible, dated and readily identifiable, maintained in an orderly manner, and retained for a specified period.					
Module 12: Operational Control					
Facility has identified operations associated with SEAs.					

Facility has planned maintenance activities to ensure that they are carried out under specified conditions.					
Operations associated with SEAs have documented procedures to cover situations where their absence could lead to deviations from the policy, objectives, and/or targets.					
Procedures stipulate operating conditions.					
Facility has a procedure related to the identifiable SEAs of goods and services provided by contractors and vendors and communicates procedures and requirements to suppliers and contractors.					
Facility or initiating activity communicates relevant facility-specific environmental procedures, work practices, and requirements to affected contractors prior to the commencement of requested work.					
Emergency Preparedness and Response					
Environmental incidents and emergencies likely to occur at the facility have been identified.					
Methods for preventing, mitigating, and responding to likely releases that require emergency response have been established and maintained at the facility and involve the appropriate response personnel.					
Roles and responsibilities for communications within the facility and for obtaining outside support services (e.g., police, fire) have been established and are maintained at the facility.					
The EP&R procedures at the facility are reviewed and revised on an annual basis or as necessary.					
EP&R methods and communications are tested as practicable.					
The facility emergency response leader records information necessary to determine corrective and preventive actions and any improvements to existing procedures that may be needed.					
Monitoring and Measurement					
Facility has documented procedures for monitoring and measuring key characteristics of operations associated with SEAs.					
Facility has established metrics to track performance, relevant operational controls, and conformance with objectives and targets.					
Monitoring and measuring equipment is calibrated and maintained as evidenced by appropriate records.					
Facility has documented procedures for periodically evaluating compliance with relevant environmental legislation and regulations.					

EMR or designee is responsible for planning, scheduling, and implementing internal environmental regulatory compliance assessments, including the identification of required resources.					
The assessment team records audit information and issues a Corrective and Preventive Action Notice (CAPAN) when appropriate. Upon completion of corrective and/or preventative actions, the responsible staff person furnishes the EMR or designee with a signed or acknowledged CAPAN (see Module 15).					
Non-conformance and Corrective and Preventive Action					
Facility has a procedure for non-conformance and corrective and preventive actions defining responsibility and authority for investigating and mitigating environmental impacts.					
Each activity within the facility is responsible for identifying specific techniques to: identify the root cause(s); take appropriate corrective or preventive action; and verify effectiveness and prevent recurrence where possible.					
Facility records and makes changes in documented procedures resulting from corrective and preventive actions.					
Records					
Facility has a procedure to identify, maintain, and dispose of environmental records.					
Each activity responsible for maintaining a record has the responsibility for establishing the method for filing and indexing the records for accessibility.					
The responsible activity is the generator of the record.					
Facility records procedure is consistent with corporate record retention procedures.					
EMS Audits					
Facility has a program and procedure for periodic EMS audits.					
The EMR or designee is responsible for planning, scheduling, and implementing internal EMS audits.					
An EMS audit team will be formed whose membership has no responsibility within the activity to be audited.					
An EMS audit schedule will be developed for each activity to be audited. Audit frequency is determined on priority basis that accounts for previous audit results and the environmental importance of the activity, and is not to be less than the interval that the facility determines.					
The EMS audit team has established a checklist of questions relating to the EMS. These questions are reviewed and amended					

as necessary based on audit findings and other factors.					
During the audit, the EMS audit team records audit observations, indicating items checked, individuals interviewed, any concerns identified and any corrective or preventive actions completed during the audit.					
The audit team documents its findings using an audit findings form.					
The area representatives address the corrective and preventive action sections within the specified time limit and return the information to the audit team and the EMR.					
The EMR notifies facility management of likely regulatory non-compliance.					
The audit team reviews corrective actions and confirms proper implementation either by a subsequent check or during the next audit.					
The EMR or designee submits audit summaries for management review.					
Management Review					
Management reviews are conducted by the EMR and the management committee.					
The EMR schedules these reviews at intervals that the facility determines.					
The management review addresses the possible need for changes to policy, objectives, and other elements of the EMS, in light of EMS audit results, changing circumstances, and the commitment to continuous improvement.					

AUTOBIOGRAPHY

He was born in İzmir on 14.03.1980. After graduating from Bornova Anadolu Lisesi, he has started undergraduate study in İ.T.Ü. Maritime Faculty, Marine Engineering Department, in 1998. He has graduated as a Marine Engineer and Oceangoing Watchkeeping Engineer in 2002, when he has also started working on Turkish Merchant Fleet. In 2003, he has started working in İstanbul Shipyard as the Management Representative and he has also started graduate study on Maritime Transportation Engineering of İ.T.Ü. Institute of Science and Technology, where he had the chance to combine theoretical knowledge with field implementation on the subjects of quality management and environmental management in the shipbuilding industry. Along his graduate study, he made studies on the implementation of integrated management systems, environmental management system applications and occupational health and safety systems in the shipbuilding and repair sectors. He had attended several national and international seminars with paper presentations. Presently, he is working as a Project Manager in İstanbul Shipyard and is married with Dr. Gülşah Nomak.